Call-A.P.P.L.E.™

World's Largest Apple User Group Magazine

DECEMBER 1985
$3.00 U.S.

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- Sinless Programming with Maxwell's DEMON
- Spreadsheet Tax Templates
- Input Anything in ProDOS

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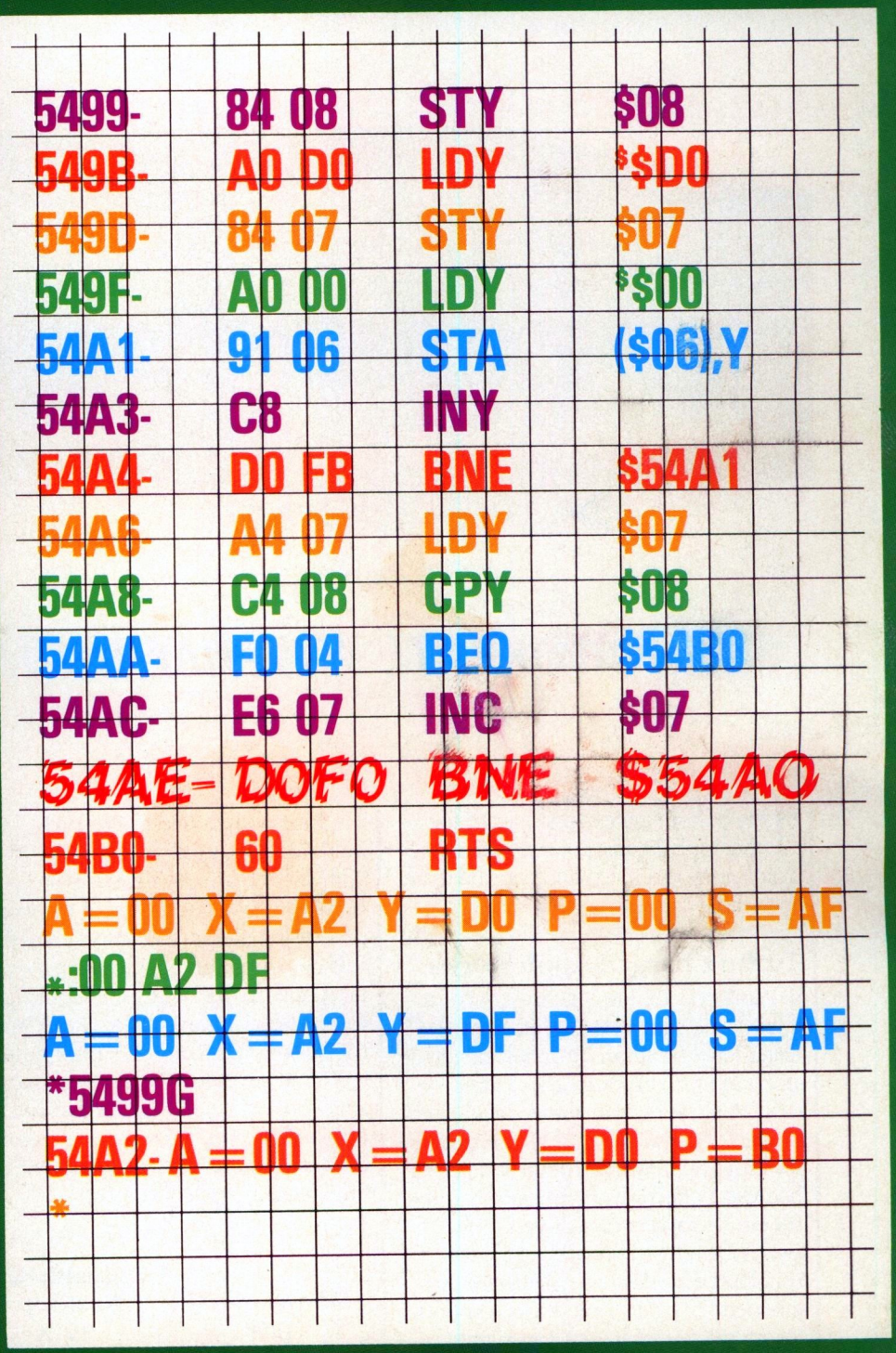
- "Willy Byte in the Digital Dimension"

MACINTOSH:

- Synthesizing Musical Instruments

PLUS:

- Getting On to BBS's
- Moving Graphics Shapes



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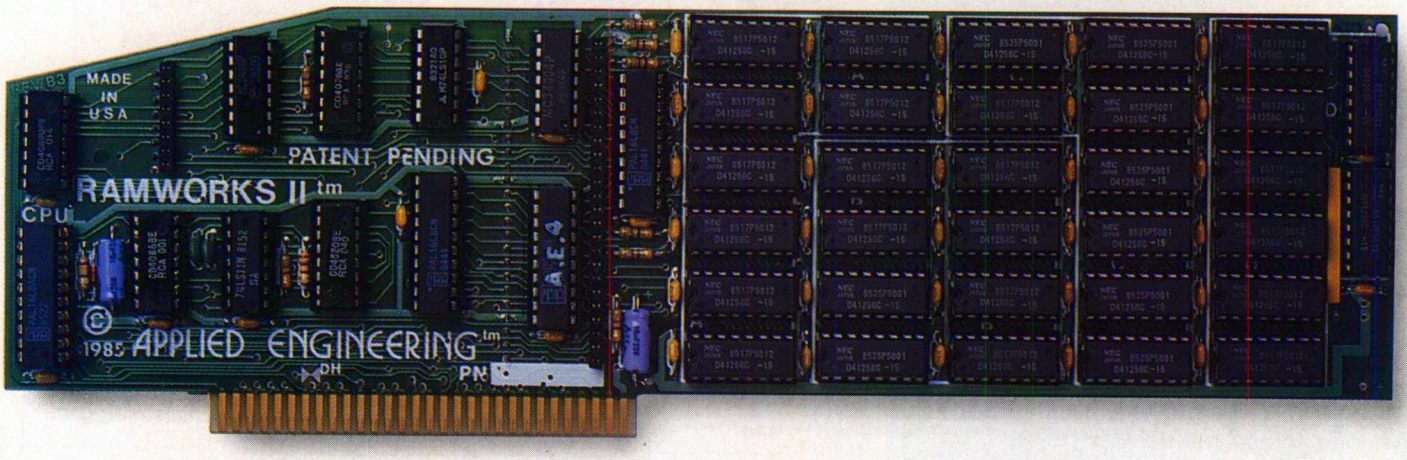
Apple PugetSound Program Library Exchange

Meet RamWorks II™

The Recognized Industry Standard For Memory Expansion of the Apple IIe.



RamWorks II. A Generation Ahead. Again.

The best selling expansion card for the Apple IIe just got even better. With RamWorks II, expand your IIe to an incredible 3 megabytes of usable RAM.

Turbo Charged AppleWorks.

RamWorks II plugs into the IIe auxiliary slot and acts just like Apple's extended 80 column card, only better—because if you buy a 256K or larger card, AppleWorks will automatically load itself into RamWorks II. This dramatically increases AppleWorks' speed and power because it effectively eliminates the time required to access disk drive 1. Now, switch from word processing to spreadsheet to database management at the speed of light. AppleWorks responds the moment your fingers touch the keyboard.

But AppleWorks has certain internal limits, independent of available memory. Fear not. Only RamWorks II (and the original RamWorks of course) removes those limits. Only RamWorks II increases the maximum number of records available from 1,350 to over 16,000. Only RamWorks II actually increases the number of lines permitted in the word processing mode. And only RamWorks II features a built-in printer buffer, so you no longer have to wait for your printer to stop before going back to AppleWorks (256K or larger RamWorks II required).

With RamWorks II, you won't have to split your data into 2 or more separate files because you'll have the necessary memory to access ALL your data ALL the time, quickly and conveniently.

RamWorks II	AppleWorks Desktop
128K	101K
256K	188K
512K	378K
1 MEG	758K
1.5 MEG	1136K
3 MEG	2277K

The Most Friendly, Most Expandable Card Available.

RamWorks II is compatible with more off-the-shelf software than any other RAM card. Popular programs like Advanced VisiCalc, Magic Office System, Flashcalc, The Spread Sheet, Diversi-DOS, Supercalc 3A, Magicalc, etc. (and hardware add-ons like Profile and Sider hard disks). Fact is, only RamWorks is 100% compatible with all software written for the Apple 80 column and extended 80 column cards. In addition, RamWorks II can emulate most other RAM cards, so you can use programs written for them without modification. And any size RamWorks II can be user upgraded later to any larger size.

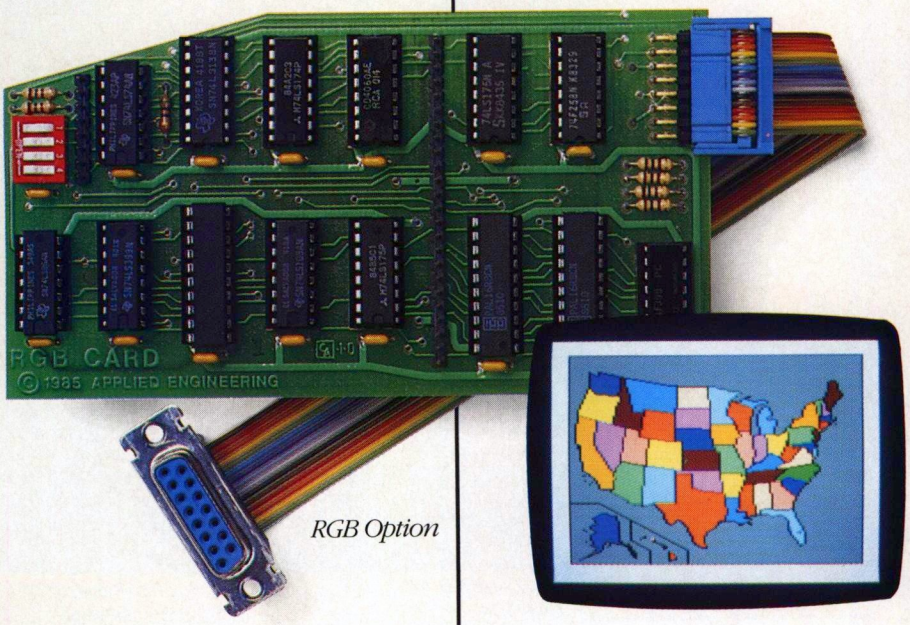
RamWorks II was designed so you could take full advantage of future developments in 16 and 32 bit microprocessors. As your needs grow, so can RamWorks II. A handy coprocessor connector allows the latest and greatest coprocessor cards to access all 3 MEG

of RamWorks II memory. And speaking of more memory, RamWorks II has a memory expansion connector on board so a low profile (no slot 1 interference) memory expansion card can add another 512K or 2 MEG of memory.

Should you ever run low on memory with RamWorks II (unlikely) you can add these expander cards to your RamWorks II at any time. And of course, these expander cards are compatible with original RamWorks too.

It's In Color.

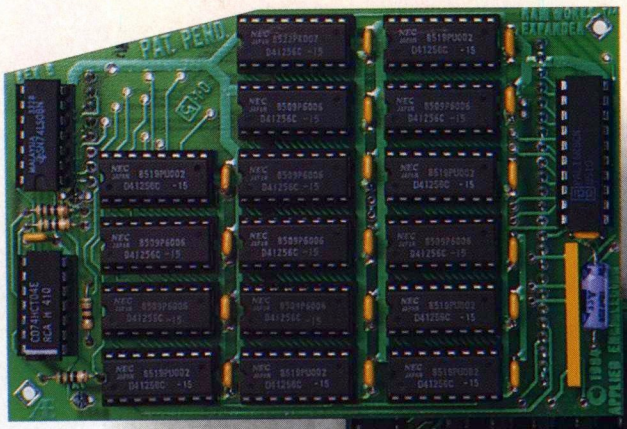
The same slot that's used for memory expansion is also the slot that's used for RGB color display. RamWorks II lets you decide later to add RGB color. For only $129, an RGB option can be added to RamWorks II to give you double high resolution color graphics and 80 column text. All with razor sharp, vivid brilliance that's unsurpassed in the industry. The RGB option does not waste another valuable slot, but rather plugs into the back of RamWorks II with no slot 1 interference (works on the original RamWorks, too) and attaches to any Apple compatible monitor. And remember. You can order the RGB option with your RamWorks II. Or add it on at a later date.



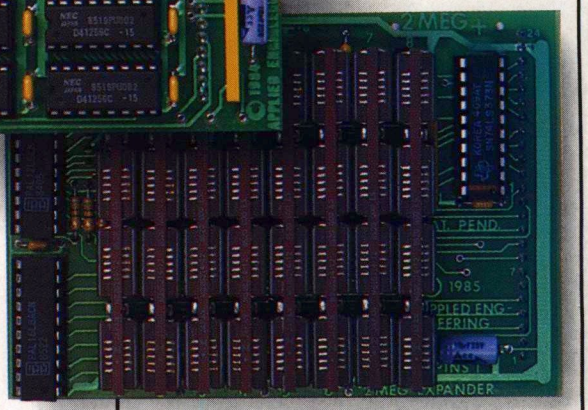
RGB Option

It Corrects Mistakes.

Let's say you bought some other RAM card (and that's a mistake) and your RAM card is not being recognized by AppleWorks, Advanced Visicalc, Flashcalc, Supercalc 3A, or other programs, and you want RamWorks II.



512K Expander



2 MEG Expander

No problem. The memory chips on the card that you now have, which is where most of the money is, can be unplugged and then plugged into the expansion sockets on RamWorks II.

It's Got It All.

- 15 Day Money Back Guarantee
- Super sharp 80 column text (patent pending) with or without RGB option
- Double high resolution graphics (with or without RGB option)
- Expandable up to 1 Meg (1024K) on main board
- Expandable to 3 Meg (3072K) with expander (piggyback) card
- Can use 64K or 256K RAMS in any combination
- Linear addressing coprocessor port
- Automatic AppleWorks expansion up to 2205K desktop
- Accelerates AppleWorks
- Built-in AppleWorks printer buffer
- The only large RAM card that's 100% compatible with all IIe software
- RAMDRIVE™ the ultimate disk emulation software included free
- 16 Bit option
- Compatible RGB option
- Built-in self diagnostics software
- No slot 1 interference
- Lowest power consumption (patent pending)
- Takes only one slot
- Software industry standard
- Advanced Computer Aided Design
- Used by Apple Computer, Steve Wozniak and virtually all software companies
- 5 Year no hassle warranty

RamWorks II with 64K	**$ 179**
RamWorks II with 256K	**$ 219**
RamWorks II with 512K	**$ 269**
RamWorks II with 1 MEG	**$ 389**
RamWorks II with 1.5 MEG	**$ 549**
RamWorks II with 3 MEG	**$1699**
RGB Option (may add later)	**$ 129**
16 Bit Option (may add later)	**$ 89**

RamWorks II. Like the original, it's rather extraordinary. But then some things never change.

ORDER YOUR RamWorks II TODAY. 9 a.m. to 11 p.m. 7 Days, or send check or money order to Applied Engineering.

MasterCard, Visa and C.O.D. welcome. Texas Residents add 5⅛% sales tax. Add $10.00 outside U.S.A.

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About the Cover

Do the unexpected gremlins which can bedevil experienced programmers arise from supernatural forces inside your computer? If so, you may need "special" tools to eradicate the little demons.

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Let's compare Apples™ to Apples™.

An Apple IIc

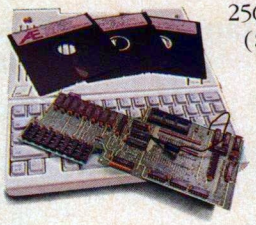
An Apple IIc with Z-RAM

The Apple IIc on the right works exactly the same as the Apple IIc on the left. Almost. The Apple on the right has a powerful memory expansion coprocessing card called Z-RAM. From Applied Engineering. Which means the Apple on the right can completely load AppleWorks into RAM—and then run it up to thirty times faster than the Apple on the left.

Z-RAM also acts as a solid-state disk drive. Which means the Apple on the right will load and store programs up to 30 times faster. And, our included RAM disk is compatible with Applesoft, PRO-DOS, DOS 3.3, PASCAL and CP/M.

Turbo Charged AppleWorks.

Even a 256K Z-RAM can completely load AppleWorks into RAM. With Z-RAM, the moment your fingers touch the keyboard AppleWorks responds. A 256K Z-RAM lets your IIc run AppleWorks up to 30 times faster, increases available desktop to 235K and maximum number of records from 1,350 to over 16,000, doubles the number of lines allowed in the word processor, provides a print spooler, and auto-segments large files so they can be saved on two or more disks. A 512K Z-RAM boosts AppleWorks desktop to an incredible 425K.



Take a closer look.

There's more. Z-RAM has a built-in high speed Z-80B microprocessor that allows you to run CP/M programs. Which means you now have access to the single largest body of software in existence, including popular packages like WordStar, dBase II, Turbo PASCAL and Microsoft BASIC. A 16 bit option is also available.

And still more. Z-RAM is compatible with all IIc software and hardware, installs easily in just ten minutes with a screwdriver (slightly longer without), is available with 256K or 512K of additional memory (a 256K Z-RAM can be upgraded to 512K at any time). Z-RAM is easily handled by the IIc power supply with our patent pending power saving design.

The only thing better than that would be a recommendation from Steve Wozniak.

> ***"I recommend Applied Engineering products wholeheartedly." (Of course, Steve's IIc has a Z-RAM installed.)***
>
> *Steve Wozniak, the creator of Apple Computer*

For fast response.

Z-RAM comes complete with simple instructions, RAM disk software, Z-80 operating system, CP/M manual. And a five year "hassle free" warranty. Make a good Apple great. With 256K Z-RAM "384K total" ($359); with 512K "640K total" ($419); 16 bit option may be added later ($89).

If you want to run CP/M software, but don't need more memory, we suggest our Z-80c card. The Z-80c has no memory expansion ports and is priced at only $159.

Call 214-241-6060 TO ORDER TODAY. 9 a.m. to 11 p.m. Seven days, or send check or money order to Applied Engineering. MasterCard, Visa and C.O.D. welcome. Texas residents add 5⅛% sales tax. Add $10.00 outside U.S.A.

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The INNER CIRCUIT

Don Elman

That's the Spirit!

Have you come to terms with the little devil inside your computer?

You know . . . the one who causes all that pain and frustration when you try to master a new language, operating system, or application software? The one who rivets your attention for endless hours through missed meals and sleepless nights as you try to fix the last bug in your masterpiece program, or add one more row to your latest, most comprehensive spreadsheet? The one who conjures up an isolated thunderstorm that shuts off your power for an instant, just as you were about to save three hours of word processing efforts to disk? The one who fires your heart with the irresistible urge to spend hundreds of dollars for the newest peripheral or expansion card, even when your budget is on the verge of collapse?

Many of us have sold a good chunk of our lives to that bewitching box full of chips and circuits, pursuing elusive pleasures while bearing the attendant crosses. As in most areas of human endeavor, after succumbing to temptation there is no sure way to extract oneself permanently from the object of attraction. Like the eternal struggle between good and evil, perhaps the best we can achieve is to hold the diabolical forces in check while exalting the virtues of our electronic messiah. In any event, if something goes wrong we can always say, "The computer made me do it!"

In This Issue

Our lead story this month, **Selling Your Soul to Maxwell's DEMON** by Larry Neibauer, is certain to enchant anyone interested in assembly language programming. This tutorial/review clearly explains why and how a good debugger utility helps to exorcise those annoying gremlins which can bedevil even an advanced programmer. Next, Jeffrey Jacques' ultimate **Spreadsheet Sheet** for 1985 deals valiantly with a topic that torments may of us this time of year–income tax planning. Ken Kashmarek's **ProDOS Input Anything Routine** extends a popular DOS 3.3 utility into the realm of Apple's newer operating system.

We also pick up the threads of two continuing series' that have appeared in these pages during previous months. The current installment of Randi Rost's **Graphics Toolkit** takes us another step toward animation of screen shapes, and Philip Chien's **The ABC's of BBS's** contains useful tips for entering the world of electronic bulletin boards. Our review section covers an Apple II spreadsheet that works with a mouse (reviewed by Steve Ross), and an educational game that teaches what goes on inside a microcomputer (Clay Ruth). William K. Dolen's **Making (Sound) Waves with Macintosh** includes a BASIC program for synthesizing musical instruments. All this, plus our regular columns and departments, add up to a tempting feast that even the most virtuous readers will find hard to resist.

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Don Elman

On the Magazine Rack

Perhaps you've noticed a new addition to our front cover—the UPC bar code in the lower left corner. As mentioned previously, we are in the process of expanding our national retail distribution, and this little cluster of lines helps certain retailers and distributors keep track of how many copies are sold.

Starting with the October 1985 issue, *Call -A.P.P.L.E.* has been available in many of the Waldenbooks stores across the country, and should start appearing in other selected retail outlets over the coming months. So the next time a friend wants to borrow your precious copy of *Call -A.P.P.L.E.* "just for a little while," feel free to tell him or her to pick one up at the store. If the store is sold out or doesn't carry it yet, ask the manager to place an order.

Macintosh and A.P.P.L.E. Co-op

As you know, since early 1985 we have devoted a significant portion of *Call -A.P.P.L.E.* to Macintosh features and products. This was done in order to serve the sizeable (and growing) minority of our members who actively use or have expressed interest in the Mac. At the same time, our Lisa/Mac special interest group (SIG) has become the largest and most enthusiastic SIG in our organization under the tireless leadership of Michael and Lisa Storrie-Lombardi, producing its own excellent newsletter, *32 Little Apples*.

Reactions to *Call -A.P.P.L.E.*'s Macintosh coverage have been mixed. Many seem to feel that the Apple II and the Macintosh have little in common beyond their corporate parent's name. Except for a small number of dual owners who straddle both camps, II users tend to resent the intrusion of Macintosh articles on the limited magazine space, and Mac users are generally unfulfilled by the few pages of interest to them.

Most Apple-specific magazines have solved this dilemma by focusing exclusively on one or the other machine. After long and careful consideration, we have decided that this is a reasonable course of action. However, A.P.P.L.E. Co-op is firmly committed to strong support for both the Apple II and the Mac, since one of our primary missions is to provide information about all major products from Apple Computer, Inc. and related, third-party companies. Therefore, *Call -A.P.P.L.E.* will be phasing out its Macintosh section after this issue. For Mac and Lisa users, we will offer our Mac SIG newsletter on a subscription basis, while developing its size and quality as much as financially feasible.

New Catalog and Ordering Policies

All active Co-op members should be receiving our new Fall/Winter 1985-86 Products Catalog around the time you get this issue of the magazine. There are many exciting new products and specials, as well as our popular continuing items. And don't forget to take advantage of the 10% discount coupon printed in the November 1985 *Call -A.P.P.L.E.*!

We would like to bring to your attention some revised policies relating to product returns and pricing. In most instances, our 15-day unconditional return policy has served members well. However, questions occasionally arise in determining whether the 15-day period begins with the date of shipment, the date of receipt, or the date of first use. Also, returned products have sometimes been used or misused in a way that renders them unsuitable for resale.

Return and Refund Policy: Effective November 1, 1985, all orders will have printed on the invoice a "return by" date that is 30 calendar days after the date of shipment. If you return a product in resalable condition by this date, with a copy of the invoice and all original packaging and documents intact and unmarked, we will credit your member account for the original purchase price, less shipping charges and a 10% handling fee. Any additional expenses we must incur for repackaging or restoring the item to stock will also be deducted from the credit. Written requests for cash or charge-card refunds are subject to Co-op approval, and will generally not be honored for software products. After the "return by" date, a returned product will not be accepted without written authorization from the Operations Division of the Co-op. *All sales are considered final 60 calendar days after the shipping date.* Manufacturer's warranties for defective merchandise may extend beyond this time period.

Price Change Policy: The price in effect at the time we offer a product is subject to change. Any increases or decreases will be announced each month in *Call -A.P.P.L.E.*, and will take effect on the first day of the issue month. Also, each new catalog entirely supercedes all previous catalogs and published announcements.

If a price goes up, we will honor all orders at the lower price that are received or postmarked before the effective change date. After that date, if the increase does not exceed 10% of the former price, we will process orders that include payment at the lower price and bill you for the difference. Otherwise, you will be contacted for further instructions.

If a price goes down, either through a special sale or a permanent reduction, and you had purchased the identical product from us at a higher price within 30 calendar days prior to the effective change date, then upon written request you may receive a credit to your member account for the difference.

Coupons: From time to time we offer special discount coupons. To qualify for a discount, the coupon *must* accompany your order—either by mail or in person.

Finally, we wish to announce that orders can no longer be accepted through The Source.

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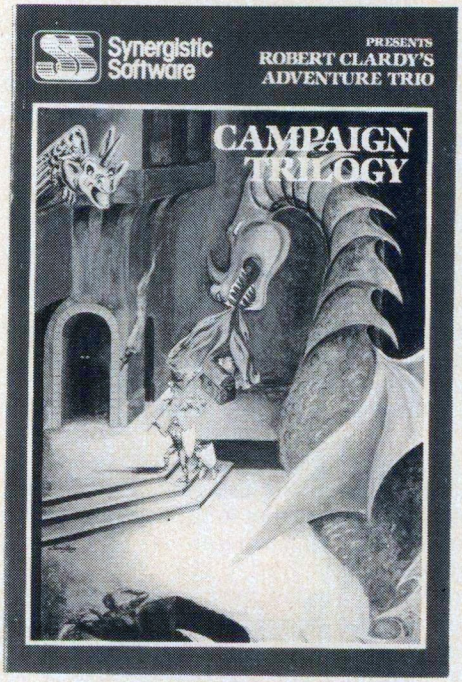

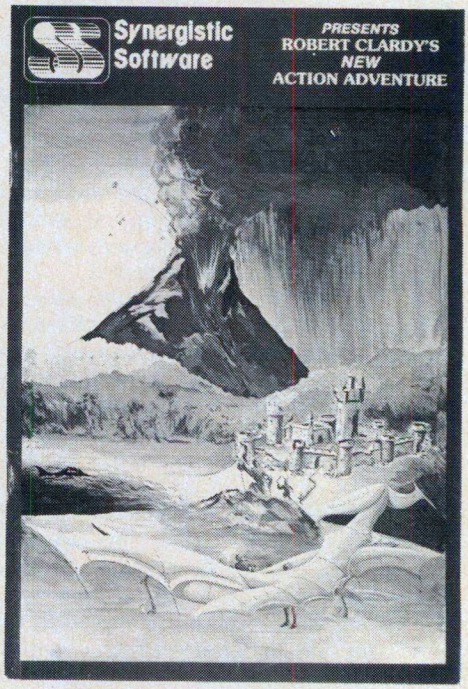

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```
10 PRINT CHR$(21): COLOR=2:
   FOR X=0 TO 39 STEP 2: FOR Y=1
   TO 47 STEP 2: Z=Z=0: PLOT
   X+Z,Y: NEXT Y,X
20 POKE 37,255
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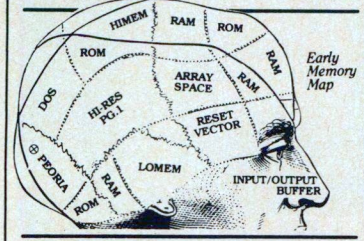

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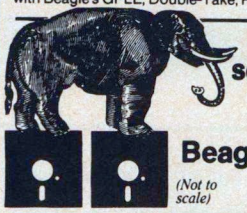

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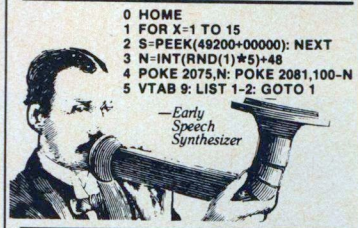

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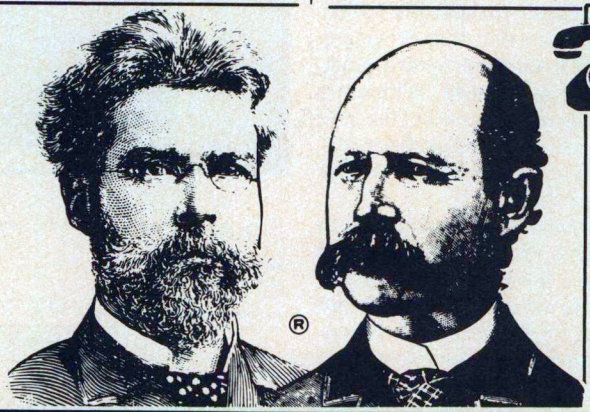

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Product:	Maxwell's DEMON™
Use:	Assembly Language Debugger/Monitor
For:	Apple II Family
Company:	Enhanceware 91 Pioneer Place Durango, CO 81301
Available From:	A.P.P.L.E. Co-op
Price:	$35.00
Product Code:	SDEMON

Larry Neibauer

MAXWELL'S DEMON™ (DE-bugger MON-itor) is an extremely powerful machine language program which, once initialized, serves as a testing ground where you can monitor the operations taking place deep within the 6502/65C02 micro processor as it carries out the instructions of your assembly language programs or routines. You need only set Maxwell's DEMON up to handle your current set of instructions. Then, simply sit back and press the space bar to "single-step" through your program exactly one machine language instruction at a time. Maxwell's DEMON continuously updates it's screen display (see Figure 1) as each instruction is processed, thus providing you with the fundamental information needed in determining whether the program is actually executing as planned. With each press of the space bar, you are shown the current contents of the processor's registers, the current state of each of the status flags, the current contents of the stack, and other internal operations such as memory access cycles and machine cycle counts.

Most de-bugging aids such as this only allow the programmer to insert "break points" at strategic locations within the program or routine, which is great. The problem arises, however, when the program misses a turn and ends up somewhere out in center field before it reaches the break point you had waiting for it at third base. Meanwhile, you're left scratching your head and wondering what went wrong, where it went wrong, and why it went wrong in the first place!

Maxwell's DEMON, on the other hand, functions interpretively. That is, it intercepts each instruction during the flow of the program, interprets the instruction, and then stores this information—as well as the current state of the microprocessor—away for later use. It then "releases" the instruction for use by the CPU and displays the results of the executed code in an organized fashion on the screen. Here you can easily examine the effects of your code on the internal registers of the microprocessor at your leisure.

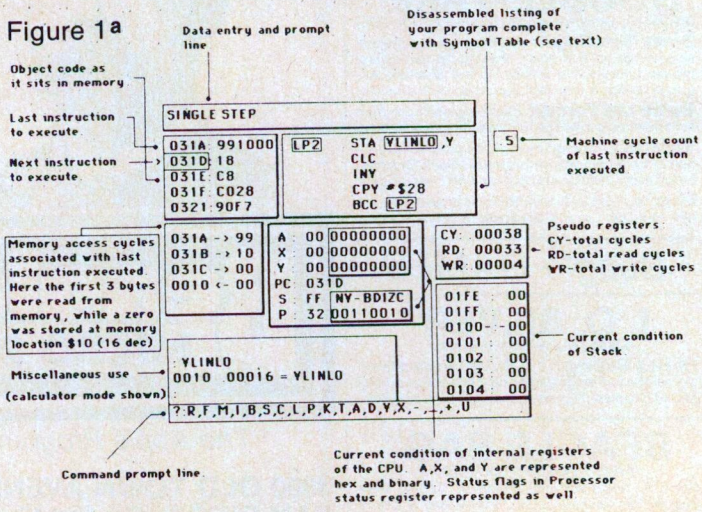
Figure 1

```
SINGLE STEP

34A0: 91E8  CLRBUF   STA (BUFFER),Y      .G
34A2: C8             INY
34A3: C421           CPY BUFSIZE
34A5: 90F9           BCC CLRBUF
34A7: 60             RTS

34A0 -> 91  A :  A0 10100000  CY:.00882
34A1 -> E8  X :  2C 00101100  RD:.00599
00E8 -> C6  Y :  5B 01011011  WR:.00084
00E9 -> 43  PC:34A2
4421 <- A0  S :  FB NV-BDIZC  01FA : 26
            P :  90 10010000  01FB : 34
                              01FC : 4C
                              01FD : 34
:$354F-.175                   01FE : 00
34A0  .13472 = CLRBUF         01FF : 79
:                             0100 : 73
?: R,F,M,I,B,S,C,L,P,K,T,A,D,V,X,-,_,+,U
```

Figure 1a



Why Use a De-bugger?

I've often wondered just how much of my time is actually spent

programming as opposed to de-bugging my assembly language routines:

First write the code and assemble it. Don't forget to save the source and object code to disk! Now exit the assembler and test the routine. Hmmm—wonder what happened? Fire up the assembler again. Load in the source and examine the code. Looks like it should have worked. Ah yes—there it is! Make the changes, re-assemble the code, and don't forget to save it to disk. Re-test. What the?—hmmm . . .

Sound familiar? One extraordinary feature of Maxwell's DEMON is it's "UNEXECUTE" command. With this little gem, you are given *complete* control over your programs execution. Let's consider the short routine in Listing 1. Enter the code using either your favorite assembler or directly into memory from the monitor. It can be run with either a Call 768 (RETURN) or from the monitor by entering 300G (RETURN). If all goes well, you're going to have to turn off the computer to regain control. Now, see if you can find out why. This is an extremely simple example, but it should serve its purpose.

This exercise shows how I first set things up to deal with this routine, and then single stepped through each instruction. If something goes wrong, I will know where and when it happens and by examining the screen display, I will know what corrections are needed. The procedure would go something like this . . .

First I load the program and the converted symbol table into Maxwell's DEMON (MD). Then I use the "R"egister command to point the PC (Program Counter) register to the beginning of the program, which is $300. Next, I set the "S"ymbol table "B"ase to point to the beginning of the symbol table and then "E"nable symbols. I now see on the screen a disassembled listing of the first five instructions of the program, complete with symbols. By using MD's "P"age "M"apping command, I re-map the primary text page to the secondary page and begin my testing.

Single stepping through the program's first 10 instructions—the next instruction, STA VLINLO,Y, should print a blank (ASCII code $A0-160 dec) to the upper left hand corner of the text screen—I use the "V"ideo command to turn on the secondary text screen and, once again, press the spacebar . . . but nothing happens. No problem . . .

I simply use the "V"ideo command to return to MD's screen display, Unexecute the last eleven instructions, (*That's right, I UNEXECUTE the last 11 instructions!)* and begin single stepping once again. This time, however, I will pay a little more attention to MD's screen display—in particular, the MEMORY ACCESS CYCLES which are displayed on the middle left hand portion of the screen (see Figure 1a for the actual screen display). This information shows me exactly what is being read from, or written to, memory as each instruction is executed. To my knowledge, there is no other de-bugging program which has this feature.

Single stepping through the program once again, all goes well until I hit the instruction at $318 (LDA $A0). This is my first mistake. (I should be loading the A register with $A0 [160 decimal]), rather than with the *contents* of memory location $A0. By executing the next instruction, STA VLINLO,Y, I discover the real problem with this routine. This instruction which is an *Absolute by Y* instruction, should be an *Indirect Indexed by Y*—STA (VLINLO),Y. Looking at the memory access cycles for this instruction (see Figure 1a), I see the actual results of the code. Rather than storing the A register at the pointer I had set up at $10-$11, which contain a $00 and $04 respectively, the program actually stores the contents of the A register at memory location $10,Y—at this point in the program the Y register equals zero. In fact, this routine—by incrementing the Y register as it does—actually wipes out zero page locations $10-$38 (16-56 decimal)!

Now that I know what happened, I simply enter MD's built-in mini symbolic assembler, change the LDA $A0 to a LDA #$A0, and also change the STA VLINLO,Y instruction to a STA (VLINLO),Y. Now I can resume my testing without having to re-boot BIG MAC, let alone the entire system.

Listing 1

```
 1                ORG  $300
 2 VLINLO         EQU  $10
 3 VLINHI         EQU  $11
 4 VTAB           EQU  $360
 5                                ;
 6                                ;
 7 CLRSCRN        LDY  #$00
 8                STY  VTAB
 9 LP1            LDY  VTAB
10                CPY  #$18
11                BEQ  EXIT
12                LDA  TABLO,Y
13                STA  VLINLO
14                LDA  TABHI,Y
15                STA  VLINHI
16                LDY  #$00
17                LDA  $A0
18 LP2            STA  VLINLO,Y
19                CLC
20                INY
21                CPY  #$28
22                BCC  LP2
23                INC  VTAB
24                JMP  LP1
25 EXIT           RTS
26 TABLO          HEX  0080008000800080
27                HEX  28A828A828A828A8
28                HEX  50D050D050D050D0
29
30
31 TABHI          HEX  0404050506060707
32                HEX  0404050506060707
33                HEX  0404050506060707

0300:  A0 00 8C 60 03 AC 60 03
0308:  C0 18 F0 1D B9 2A 03 85
0310:  10 B9 42 03 85 11 A0 00
0318:  A5 A0 99 10 00 18 C8 C0
0320:  28 90 F7 EE 60 03 4C 05
0328:  03 60 00 80 00 80 00 80
0330:  00 80 28 A8 28 A8 28 A8
0338:  28 A8 50 D0 50 D0 50 D0
0340:  50 D0 04 04 05 05 06 06
0348:  07 07 04 04 05 05 06 06
0350:  07 07 04 04 05 05 06 06
0358:  07 07
```

How Useful Is It?

A disadvantage of using an interpretive de-bugging aid is it's drastic reduction in the execution speed of the program, especially when you have to pass through code known to be functioning correctly in order to get to the code you need to test, or if you're testing an extremely long program.

First let's consider the speed reduction issue. We can actually use this to our advantage since we are only testing code in the first place. The information presented on MD's screen display would be of little value if it changed so rapidly that we didn't have time to examine it. Maxwell's DEMON does provide a couple of options, one of which is the RUN command. This eliminates the need to press the space bar each time we want to execute another instruction. The speed improvement is minimal, but it does save on finger wear and tear. At this point the screen display is changing fairly quickly anyway. Another option is to put MD into it's TRACE mode. This shuts off nearly all screen updates. Here the speed improvement is significant, however it still falls far short of the lightning fast speed of unencumbered machine code.

If, however, you really don't want to wait for the working code to execute, or if you want to test a routine near the end of a long pro-

gram, you have the option to simply point the program counter (PC register) to the code you want to test and be done with it! A few keystrokes and you can point to any location in computer memory. As funny as that might sound, it would really be useful if, say, you wanted to examine how the Apple goes about clearing the screen, or how it goes about doing anything for that matter. Just point to the routine you want to examine and single-step to your heart's content.

This brings up an excellent point which the beginning assembly language programmer should pay attention to, because Maxwell's DEMON is a tremendous tool to help you learn and understand 6502/65C02 assembly language programming. If you are uncertain how a particular addressing mode works, you can watch it happen on the screen display. Or if it is unclear to you how the conditional branch instructions work and how the state of the status flags determine the results of these instructions, here again just watch the screen as the flags are cleared or set and see where the instruction branches to. I don't think there is anything that can't be learned or understood more clearly just by stepping through the routines already in the Apple, or from any other source for that matter. Just set Maxwell's DEMON up. Then point, single-step, study and learn.

I've learned that Maxwell's DEMON is also great for "fine tuning" routines. One of the problems I have with assembly language is the fact that I'm just a little bit lazy. If I've had trouble getting a particular routine to work correctly, I'm so overjoyed when it finally does work that I'm sometimes content to leave it at that. The problem is that, deep down inside, I know that the code could be written more efficiently. It could probably be shortened, thus saving space. And it could probably be written to run much faster (shorter doesn't necessarily mean faster, right?).

By watching the screen display, in particular the "CY" (total cycles) pseudo register, and also the cycle count of the last executed instruction in the upper right hand corner of the screen, it's very easy to tell precisely how long a given program or section of code is taking to execute. Combined with the capability of watching a disassembled listing of the code (with symbols) as it executes under your control, you can see how easy it would be to edit your code and rid it of repetitive instructions, unneccessary steps within loops, etc.

Table 1 represents a list of the primary commands used to control Maxwell's DEMON. I say primary commands because most, if not all, of these single letter commands invoke another list of command options. For instance, upon entering a "F" (Flag command), you are presented with this series of options: N,V,B,D,I,Z, or C, which represent the Negative oVerflow, Break, Decimal, Interrupt, Zero, and Carry flags respectively in the 6502 (P—program status) register.

As you can see from just the primary set of commands, you are given a lot of power as well as flexibility while working with Maxwell's DEMON.

Table 1

Primary Control Commands for Maxwell's DEMON

T	**TRACE** Use to set up MD's Trace Mode which allows you to selectively enable or disable MD's screen updating thus speeding up the actual running of the program being tested.
A	**ASSEMBLER** Use to enter MD's built-in mini symbolic assembler. Two modes are available. **ASSEMBLE** and **ASSEMBLE AND EXECUTE.** Assemble mode assembles and stores each instruction as it is entered from the keyboard. The assemble and execute mode does the same, but it also executes each instruction as it is entered thus allowing you to immediately see the results of an unfamiliar instruction or addressing mode.
D	**DOS** Use to enter DOS commands.
V	**VIDEO** Allows selecting **TEXT, LORES,** or**HIRES** pages one or two, as well as either full screen graphics or mixed text and graphics.
X	**EXIT** Use to gracefully exit MD and enter the Apple monitor. **UNEXECUTE COMMAND** Use to actually backstep though the program up to as many as **16** instructions. All registers and memory locations are restored to the values they contained just before the instruction had been executed.
<SPACE>	**SINGLE STEP COMMAND** Causes the next instruction in the code to execute.
+	**RUN** The program instructions will execute continuously until (a) the breakpoint expression evaluates to "TRUE," (b) a **BRK** instruction is encountered, • any key on the keyboard is pressed.
U	**USER** This will result in a no-op unless code has been added by the user to implement a specific function.
?	**HELP** When present, press for info for various commands.
R	**REGISTERS** Use to modify the 6502 A,X,Y,S or PC registers, as well as MD's CY,RD,WR, pseudo registers.
F	**FLAGS** Use to set/clear N,V,B,D,I,Z or C flags. In 6502 **P**-(program status) register.
M	**MEMORY** Use to examine and/or store data into one or a sequence of memory locations.
I	**INTERRUPT** Use to simulate either an interrupt request (IRQ), a non-maskable (NMI) interupt, or a hardware reset.
B	**BREAKPOINT** Use to specify a breakpoint expression, list the current breakpoint expression, and enable or disable breakpoint checking.
S	**THE FIRST CHARACTER OF TWO DIFFERENT COMMANDS.**
ST	Use to manipulate the **ST**ACK.
SY	Use to control **SY**MBOLIC mode or to manipulate the symbol table.
C	**CALCULATOR** Use to enter calculator mode which will evaluate any expression and display its value in both decimal and hexadecimal notation. Any symbol with that value, if a symbol table exists, will also be shown.
L	**LIST** Use to enter symbolic list mode. Similar to the list command in Apple monitor except that the symbol table (if present) is used to substitute labels and other symbols for hex addresses and values.
P	**PAGE ASSIGNMENT** Use to remap the physical memory space to behave like a different computer or to allow the running of a program at one location when it was actually **ORG**'ED for a different one.
K	**SKIP** Use to skip an instruction or an entire routine that is known to be working correctly.

How Do I Set It Up?

I've mentioned in passing that there is a little set-up procedure involved before you can utilize the many features of Maxwell's DEMON. What follows is an explanation of that procedure, which is intended to provide you with a little taste of what it's like to use Maxwell's DEMON. Don't let the description scare you away, because although this procedure takes some time to explain, once you understand what's going on, the whole sequence of steps can be carried out in no more than a minute or two. This short amount of time can translate into hours saved in de-bugging time.

The first things to consider before attempting to use Maxwell's DEMON are where your program will reside in memory and it's total length. If your program contains no labels and produces no screen output, then you will normally have available to you memory locations $800...$67FF. That's over 22K of space, which should be enough room for most of your programming needs. In this case all that would be necessary would be to load your program into the debugging monitor, set the Program Counter register to the beginning of your routine, and begin your testing.

However, if your program does contain labels and/or produces screen output, then a little more planning and set-up time is needed.

Maxwell's DEMON is a "symbolic" de-bugging environment. That is, it will utilize the symbol table that was created by the assembler when you originally laid down and assembled your code. This then allows you to follow the program's flow on the screen display using essentially the same disassembled listing (including your labels) that you would see if you were to "LIST" your program from within the assembler's editor!

Maxwell's DEMON presently supports only those symbol tables created by either the BIG MAC or MERLIN assemblers. My impression, however, is that the "Get Symbol" programs which extract the symbol tables and convert them to the needed format will be provided by Enhanceware on a supply and demand basis. So, if you are using a different assembler, *let them know which assembler it is when you send in the registration card.* Or possibly write a "Get Symbol" program of your own (some info provided in manual) and send it in to Enhanceware. They just might publish it.

Why Are Apple Owners So Loyal?

People who have the best often are, but in the case of Apple there's more. Apple owners think back to how Apple got started in 1977, just two people working out of a garage and what happened is the talk of Wall Street and the computer industry as well. Many like the fact that Apple only makes computers. Unlike their competition they don't make typewriters, copiers or telephones. They do just one thing and that's one reason they do it so well.

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What this is all leading to is that if your program contains symbols, and if you intend to us them during testing, then you will need to use this information when deciding which version of Maxwell's DEMON to use, as well as which of the "Get Symbol" programs to use.

On the master program disk, there are four versions of Maxwell's DEMON and two versions of the Get Symbol programs. These are named:

1. DEMON
2. DEMON.C
3. DEMON.800
4. DEMON.C.800
5. GS.MBM.800
6. GS.MBM.3600

Of the DEMON programs, those followed by ".800" load and run at $800, while the others operate at $6800. The ".C" indicates that those versions support the extended instruction set of the 65C02 processor. On the other hand, the GS.MBM (Get Symbol) programs each store the symbol tables at $800 and $3600 respectively. Which of these GS.MBM programs you use is entirely up to you because the converted table can be loaded anywhere in memory as long as it's within the boundaries of the free space available to your program.

For testing purposes, I "ORG" my routines to $0C00 (due to screen output), and use DEMON (I work on a II+ which of course uses a 6502). This version runs at $6800. Those with a *//c* or extended *//e* would more than likely use the .C versions. I then use GS.MBM.3600 to acquire my symbol tables and load the converted table just below DEMON. Just where you load the table depends upon its total length, but the closer you keep it to DEMON the more space you'll have for your programs. This is because the first byte of the table minus 1 represents the last memory location available to you and your program.

Having decided which versions of these programs to use, the next step would be either to enter your code in the assembler's editor or load it in and assemble it. If you entered it into the assembler, be sure to save both the source and object code to disk. Once the code is safely on disk, you can re-format your symbol table (if there is one) by following the procedure below:

1. From the BIG MAC/MERLIN main menu, press "C" to catalog your working disk in order to enter the assemblers "EXEC" command level.
2. At the "COMMAND:" prompt, type "BRUN GS.MBM.3600" followed by a carriage <RETURN>.
3. Once the drive stops, press <RETURN> again to return to the assembler's main menu.
4. Next press "E" to enter the "Editor".
5. At this point you would type USER followed by a carriage <RETURN>.

With this you are presented with the following information.

START $3600
END $nnnn (dependent on size of symbol table)
LENGTH $llll (dependent on size of symbol table)

Having made note of the starting address and length of the newly re-formatted table, the next step is to save it to disk. This is accomplished by first:

6. Pressing "Q" followed by <RETURN> to exit the Editor.
7. Pressing "Q" once again to exit the assembler.
8. From the Applesoft prompt, type "BSAVE MYTABLE.SYM,A$3600,$Llll" where MYTABLE could be any name you desire and (llll) represents the length of the current table.

This procedure need only be done one time unless you change the table at the assembler level.

After accomplishing the conversion, simply BRUN the DEMON version you have decided to use. Once Maxwell's DEMON is initialized, you will see on the monitor's screen a display something like that in Figure 1, except that it will contain no program.

To bring in a program to the testing environment, you would use the "D"os command. Then, just as you would from the Applesoft prompt, type "BLOAD MYFILE". If you are using a converted symbol table you would bring it in the same way, except that for this file you would specify where you want it loaded—normally just below DEMON if using the $6800 version. The manual goes into great detail concerning this aspect of the set-up procedure.

After that, we set the symbol table base address to the location we loaded the table at, "E"nable the symbol table, and by pressing an "R"egister followed by a "P"rogram counter register, set the register to the beginning of our program. If the routine to be tested does not produce screen output, we can now begin testing. If it does, then we have one more item to deal with—where is this output going to go?

Besides the UNEXECUTE command, the single most powerful feature of Maxwell's DEMON is it's dynamic screen display and the wealth of information it contains. The problem here is that Maxwell's DEMON has priority over the use of the primary text screen, thereby placing it off limits to our testing. This conflict is easily settled by using MD's Page Mapping command. With this command, we can re-map or "phantom" the primary screen memory to the secondary screen area. Having done this, any output directed to the primary screen will actually show up on the secondary screen and allow both Maxwell's DEMON and the program being tested to run unimpeded. The procedure to accomplish this re-mapping is surprisingly straightforward.

To re-map the primary text screen memory ($400-$7FF) to the secondary text screen ($800-$BFF), you would first use the "P"age command followed by "M"ap. MD then prompts you for the beginning page number which would be answered with a "4." You are then asked to tell MD the ending page number of the area to be re-mapped. In this case the appropriate response would be "7." Next you are asked for the page number that is to represent the destination of the memory re-map. Since you are moving the primary text screen,—pages 4-7 to the secondary screen which begins at $800 or page 8—you would answer with "8." It's that simple. Five keystrokes and you can re-map the Apple memory into any configuration you might imagine. You are not limited to only one re-mapping sequence.

After this we would be ready to begin testing. Although the procedure takes a while to explain, it is straightforward and can be done rather quickly with a little practice.

Words of Wisdom

Before closing, I would like to pass on a couple of items that can save you even more time in the testing phase of your programming efforts. First, I've found it extremely useful to create a working disk which contains only my assembler and the version of Maxwell's DEMON that I need to use. Also, since I find it convenient to use my symbols in testing, I also include the GS.MBM.3600 file on this disk. (You might find it more convenient to use the GS.MBM.800—the decision is entirely up to you.) Using this work disk allows me to create and edit my code, convert my symbol tables, and then test the code, all without having to change drives or swap disks.

The second tip is useful only for testing those routines that produce screen output. When testing a routine in this situation, you need to use MD's "V"ideo command. This command allows you to examine the Text, lo-res, and hi-res screens during testing. In the case of "T"ext, you have the option to view the primary screen "1" which is MD's display, or the secondary screen which you have set up to act as the primary text screen. However, once you have gone through the re-mapping procedure described above, and after giving the "V"ideo, "T"ext, and "2" commands needed to tell MD to display the secondary screen, you will see that the screen is full of "garbage." This garbage is the data that happens to be occupying the memory represented by the secondary text screen and needs to be eliminated before your program can make use of the screen—to

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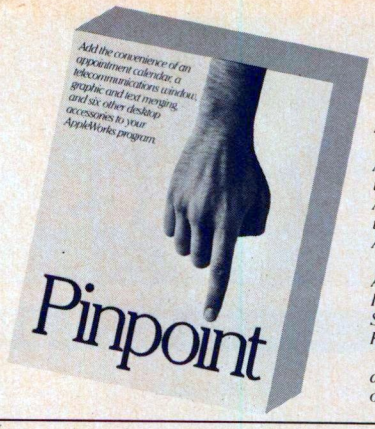
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Listing 2

```
1            ORG  $300
2 VLINLO     EQU  $10
3 VLINHI     EQU  $11
4 VTAB       EQU  $360
5                              ;
6                              ;
7 CLRSCRN    LDY  #$00
8            STY  VTAB
9 LP1        LDY  VTAB
10           CPY  #$18
11           BEQ  EXIT
12           LDA  TABLO,Y
13           STA  VLINLO
14           LDA  TABHI,Y
15           STA  VLINHI
16           LDY  #$00
17           LDA  #$A0
18 LP2       STA  (VLINLO),Y
19           CLC
20           INY
21           CPY  #$28
22           BCC  LP2
23           INC  VTAB
24           JMP  LP1
25 EXIT      RTS
26 TABLO     HEX  0080008000800080
27           HEX  28A828A828A828A8
28           HEX  50D050D050D050D0
29
30
31 TABHI     HEX  0404050506060707
32           HEX  0404050506060707
33           HEX  0404050506060707

0300: A0 00 8C 60 03 AC 60 03
0308: C0 18 F0 1D B9 2A 03 85
0310: 10 B9 41 03 85 11 A0 00
0318: A9 A0 91 10 18 C8 C0 28
0320: 90 F8 EE 60 03 4C 05 03
0328: 60 00 80 00 80 00 80 00
0330: 80 28 A8 28 A8 28 A8 28
0338: A8 50 D0 50 D0 50 D0 50
0340: D0 04 04 05 05 06 06 07
0348: 07 04 04 05 05 06 06 07
0350: 07 04 04 05 05 06 06 07
0358: 07
```

be more accurate, before you can make any sense of the information produced by your program on that screen.

The solution is simple and the reason for the short routine in Listing 2 (the one that works!). For testing purposes, simply place this routine at the beginning of your program. Then, when you begin testing, the first thing to happen is that the screen will be cleared and readied for your screen output. Just for the fun of it, you might run this program by itself and make note of the total number of machine cycles it takes for it to finish its job. Then set the Program Counter register to $FC58 and see how long it takes the Apple to accomplish the same feat. Granted, it's taking care of a few more chores, but it does take longer; and besides, it's a good way to tell if there's a faster way of doing things, especially if you don't need the computer to keep track of certain tasks for you. If you so choose, simply do a JSR $FC58 at the beginning of the program. Both routines accomplish exactly the same thing.

In summary, I find Maxwell's DEMON to be an extremely effective tool which I can use to test my assembly language programs or routines. I use it to "fine tune" my routines to run faster and to take up less space in memory as well. It is powerful yet flexible, and still small enough so that all but very large programs can be tested without trouble. It is easy to learn and, while being an effective debugging aid, is at the same time a powerful teaching aid as well. Whether you're a veteran assembly language programmer or just starting out, I feel that this program is one that belongs right beside your assembler. A de-bugging aid such as this makes sense, and I think that once you've used it, you too will sell your soul to Maxwell's DEMON.

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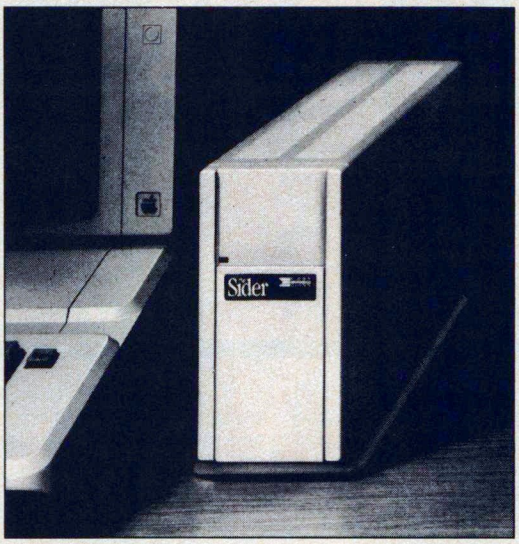

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THE Spreadsheet Sheet—Tax Templates

Jeffrey M. Jacques

THIS is one of a series of templates that is fun, and perhaps money saving, to build. It combines a fair amount of text and a variety of THE Spreadsheet functions, while giving you an opportunity to test several scenarios which may help you save on the tax dollars you pay next year. Knowing the impact of a major purchase (e.g., that hard disk for your Apple) on your taxes—assuming that you can deduct it as a legitimate expense—may help you in the decision making process.

Even if you do not wish to use these tax templates, a close look at them will help you review the effective use of the @LOOK-UP function and master the additional commands of setting /ATTRIBUTES and working with complex @IF statements. So, take a few minutes and work through these templates.

It should be noted at the outset that I am not an accountant, but merely an experienced taxpayer like most of you. Also, I built these templates using the tax forms for last year, since the new ones were not available in time to get this article published before the end of 1985. You should therefore be alert for any changes that may appear in the new forms and incorporate them in your spreadsheet.

The Problem

The old saying that there is nothing as sure as death and taxes is all too true. Now, we cannot do anything about death, nor can we do anything about setting tax rates. But these templates can help you: (1) estimate your taxes, (2) examine the impact of alternative strategies in estimating the amount of taxes you will pay, and (3) reduce the number of computational errors—errors so often found when working with tax forms. While the Internal Revenue Service (IRS) constantly strives to collect our tax dollar and simplify the basic tax form, the old standby used by millions of us—Form 1040 with its supplemental schedules, Schedule A and Schedule B—still requires considerable work.

The Solution

So, here are three templates, based on 1984 IRS standards. The first template is Schedule A—Itemized Deductions. The second template is Schedule B—Interest and Dividend Income. The third template is FORM 1040. All templates have been constructed for the typical person who: (1) needs to use the standard Form 1040, (2) lists additional interest and/or stock income, and (3) wishes to see the impact of itemizing deductions. I assume that you qualify to use the traditional FORM 1040, and that the tax rate schedule of X, Y or Z are good estimates of your taxes. (I have found that these tax rate schedules yield about the same tax amounts as those listed in the Tax Table. Therefore, they will help you to effectively examine the impact of alternative strategies.) I assume also that Congress and the President will not fundamentally alter the federal income tax system until next year. If these assumptions are true, then you will find these templates useful.

In developing the enclosed templates, I decided to include as much of the tax form as possible. This will help facilitate the transition from your electronic worksheet to the paper document you get from the IRS. If you are entering the template by keying in the data in Tables 1 through 5, then you may wish to abbreviate the labels. Make sure, however, all values and formula are in the appropriate cells. A quicker way to get this template is via a modem and a call to the A.P.P.L.E. Crate Bulletin Board to download the template. Then, get your tax information that you plan to enter on these forms.

Using Attributes

Looking at the Tables, you no doubt recognize a reasonable facsimile of the IRS Schedule A and B, and FORM 1040. A quick excursion from column B through I will display Schedule A; columns K through R will display Schedule B; columns T through AB will list page 1 of FORM 1040; and columns AD through AL will list page 2 of FORM 1040. Further on you will find a series of @LOOK-UP tables.

Given the amount of work required to enter all the labels and coded values, and given the ease with which one could hit a RETURN key or other data entry keys, I recommend "protecting" all the cells which include labels or formulae. If you have downloaded the template, then you will find that you will not be allowed to enter any value or label in cells with labels or formula—at least for now. If you try to enter a value or a label in a protected cell, THE Spreadsheet will beep at you and indicate that you have given a command which conflicts with the cell attribute—or you can't do that. Go ahead and try entering something in cell A1. What happened? . . . Just as I promised! (To continue, press RETURN and the error message will disappear.)

If you are keying in the template data, then you can protect all your entries with the sequence /GAP —or,

ENTER	DISPLAYED ON PROMPT LINE	MEANING
/	/: ABCDEFGILMPRSTW-	ENTER COMMAND
G	GLOBAL: CORFA	GLOBAL COMMAND
A	ATTRIBUTE: DAVPHM	ATTRIBUTE ASSIGNMENT
P		ATTRIBUTE: PROTECTED

You might be asking yourself the question, "Well, if all the cells are protected, how can I enter any of my data?" Good question. As in all cases, setting global parameters takes second place to setting individual cell parameters. So, we can enter a set of options which limit data entry to the type of information that is appropriate to cells requiring our input. Our choices include:

CHOICE	MEANING
A	Accept All entries
L	Accept only labels
V	Accept only values

In columns H and I of Table 1 (i.e., Schedule A—Itemized Tax Deductions), therefore, cells have attributes of /AV—since only values are valid entries. (See Table 1.) In Table 2 (i.e., Schedule B—Interest and Dividend Income), column R uses the same attribute command while cells in the body of the table use /AL, which will accept any entry as a label for payer's name, sources of interest, etc. In summary, by setting specific cell attributes to accept only certain entries or all entries, we can have the user enter the essential values while allowing the GENERAL parameter (/GAP) to protect all cells with essential template formulae, values or labels.

Schedule A

If you would like to see the possible impact of itemizing, then complete columns B through I. This is the template area for Schedule A. Column B, row 3 asks you to

TABLE 1 Schedule A Itemized Tax Deductions

	A	B	C	D	E	F	G	H	I	J
1				Schedule A --Itemized Deduction s						
2	========	==========	=====	==========	==========	==========	==========	==========	==========	===
3	Jacques	Medical	1	Medicines and drugs			$			
4	09/01/85	and	2a	Doctors,de ntists,ins urance			$			
5	Press !	Dental	2b	Transporta tion and l odging			$			
6	until tax	Expenses	2c	Other medi cal and de ntal expen ses:						
7	tax			a. Doctors , dentists , hospital s, etc.			$			
8	values			b.			$			
9	do not			c. Other (equipment , etc.)			$			
10	change						$			
11			3	Add lines 1 thru 2c:				@SUM(H3.H10)		
12										
13			4	Multiply a mount on F orm 1040-3 3 by .05				@ROUND(.05*AL3,0)		
14			5	Subtract l ine 4 from line 3.				$$$$$$$$$$	@IF((H11-H13)>=0,H11-H13,0)	
15		----------	-----	----------	----------	----------	----------	----------	----------	
16		Taxes	6	State and Local inco me			$			
17			7	Real Estat e			$			
18			8	a General Sales			$	@IF(AL3=0,0, @LOOKUP(AL3,AN42.AN59)		
19				b General Sales on motor vehi cles			$			
20			9	Other (lis t--persona l property			$			
21							$			
22			10	Add lines 6 through 9					$ @SUM(H16.H21)	
23		----------	-----	----------	----------	----------	----------	----------	----------	
24		Interest	11	a. Home mo tgage inte rest paid to inst.			$			
25		Expenses		b. Home mo tgage inte rest paid to ind.			$			
26				name & address:						
27			12	Credit car ds and cha rge accoun ts			$			
28			13	Other (lis t)			$			
29			14	Add lines 11a throug h 14.					$ @SUM(H24.H28)	
30		----------	-----	----------	----------	----------	----------	----------	----------	
31		Contribu-	15	a. Cash co ntribution s < $3,000			$			
32		tions		b. Cash co ntribution s >=$3,000			$			
33							$			
34							$			
35			16	Other than cash			$			
36			17	Carryover from prior years			$			
37			18	Add lines 15a throug h 17.					$ @SUM(H31.H36)	
38		----------	-----	----------	----------	----------	----------	----------	----------	
39		Casualty								
40		& Theft	19	Total loss					$ (ENTER VALUE)	
41		----------	-----	----------	----------	----------	----------	----------	----------	
42		Miscellan-	20				$			
43		eous De-	21				$			
44		ductions	22				$			
45							$			
46			23	Add lines 20 through 22.					$ @SUM(H42.H45)	
47		----------	-----	----------	----------	----------	----------	----------	----------	
48		Summary of	24	Lines 5, 1 0, 14, 18, 19, & 23					$ @SUM(I3.I46)	
49		itemized	25	Filing sta tus deduct ions					$ @IF(@OR(AB15=2,AB15=5),3400, @IF(@OR(AB15=1,AB15=4),2300, @IF(AB15=3,1700,0)))	
50		Deductions	26	subtract l ine 25 fro m 24.					$ @IF(I48-I49)>=0,(I48-I49),0)	

enter your medicine and drug expenses. Immediately below this cell, list your remaining medical, dental, etc. expenses. All medical expenses are summarized in cell H11. The amount of medical expense deduction (cell I14) is computed by taking the difference between cell H11 and H13. If the total amount of medical deductions listed is less than 5% of your adjusted gross income—a value to be entered later—then a value greater than zero will be displayed in cell I14. (By the way, this five percent figure was computed with the expression @ROUND(.05*AL3,0)). Alternately, if the medical expenses were greater than 5% of your adjusted income, then the remaining difference between your actual expenses and 5% of your adjusted income is displayed. All this is accomplished automatically with the use of the simple @IF expression:

@IF(H11-H13)>=0,H11-H13,0)

You say that you have not entered your income yet. Right. You will enter the essential data when you start working with FORM 1040. This does bring up an important point about forward referencing. In most articles on using spreadsheets, there generally is a warning against forward referencing of cells. I warn against it, too; but I find it necessary, given the structure and complexity of the tax forms, to use it in this template. Your results will not be correct, therefore, until you enter the data for FORM 1040 and press the recalculation key ! several times. Since each part of the template has an impact on another part, make sure that you press the recalculation key ! several times. We'll have more to say about this later.

The rest of the Schedule A template requires little explanation. Just enter the appropriate values in column H or, in the case of a casualty or theft, column I.

There are, however, two exceptions. First, general sales tax amount, cell H18, was computed with a @LOOK-UP function:

@LOOKUP(AL3,AN42...AN59)

As you will recall, the @LOOKUP function references a value, in this case cell AL3—adjusted gross income, and finds a value, in this case the estimated amount of sales tax—cells AO42 through AO59. The returned value is based on finding the adjusted gross income in the list of cells AN42 and AN59.

In some instances, the value to be returned must be computed. This is the case if your adjusted gross income is beyond $40,000. Using Florida data for a family of four, the expression is:

```
@IF(AL3>100000,
415 + (100000-40000)/5000*21,
   (415+((@INT((AL3-40000)/5000)
   +1)*21)))
```

That is, if the adjusted gross income stored in cell AL3 is more than $100,000, then compute the difference between $100,000 and $40,000, divide it by $5,000 (which yields the number of intervals you will be charged), and then multiply it by $21 per interval. Finally, add this value to $415 to estimate your sales tax. Alternately, if your adjusted gross income is less than $100,000, then find the difference between your adjusted gross income and the $40,000 minimum, compute the number of $5,000 intervals, add 1 to the number of intervals (since any part of an interval converts to the next higher interval), multiply this computed amount by the $21 tax for each interval, and then add $415 to estimate your sales tax. See Table 5 for all the LOOKUP tables used with these templates.

The second exception involves the retrieval of filing status deductions—see row 49, IRS line 25, of Table 1. While the sum total of all itemized deductions is computed easily in cell I48, computing the amount that you can claim against your tax liability requires that you state your filing

TABLE 2. Schedule B--Interest and Dividend Income

	K	L	M	N	O	P	Q	R	S
1				Schedule	B--Interes t and Divi dend Incom			e	
2	========	=====	==========	==========	==========	==========	==========	==========	===
3	Part 1								
4	Interest		Interest i ncome from	seller fi nanced mor tgage			$		
5	Income		Name of Pa yer:						
6									
7									
8									
9									
10		2	Other Inte rest:						
11							$		
12							$		
13							$		
14							$		
15							$		
16							$		
17							$		
18							$		
19							$		
20							$		
21							$		
22							$		
23							$		
24							$		
25							$		
26							$		
27		3	Add lines	1 thru 2	Write on l ine 8-1040			@SUM(R3.R26)	
28	--------	-----	----------	----------	----------	----------	----------	----------	
29	Part II		Name of pa yer						
30	Dividend	4					$		
31	Income						$		
32							$		
33							$		
34							$		
35							$		
36							$		
37							$		
38							$		
39		5	Add amount s on line	4.				@SUM(R29.R38)	
40		6	Capital ga in distrib utions			$		XXXXXXXXXX	
41		7	Nontaxable	distribut ions.		$		XXXXXXXXXX	
42		8	Exclusion	reinvestme nt divid.		$		XXXXXXXXXX	
43		9	Add lines	6,7, & 8			$$$$$$$$$$	@SUM(Q40.Q42)	
44		10	Subtract l ine 14 fro m 10.				$	+R39-R43	
45	--------	-----	----------	----------	----------	----------	----------	--------	

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status and indicate an amount in cell I49. This is automatically done for you with the following expression:

```
@IF(@OR(AB15 = 2,AB15 = 5),3400,
  @IF(@OR(AB15 = 1,AB15 = 4),2300,
    @IF(AB15 = 3,1700,0)))
```

So, if your filing status is 2 or 5, $3400.00 will be entered; if your filing status is 1 or 4, then $2300.00 will be entered; and if your filing status is 3, then $1700.00.

If all you are interested in is the tax template, then skip this paragraph. If you are interested in how this @IF statement works, then read on. It includes our typical @IF structure:

```
@IF(condition = true, then, else)
```

But the condition is first defined in a complex way (using the logical @OR function). Where this is true (AB15 = 2 or AB15 = 5),

```
@IF(@OR(AB15 = 2,AB15 = 5),3400,
```

then assign a value of $3400.00. Where this is false (anything else), then do the following @IF checking the condition (AB15 = 1 or AB15 = 3).

```
@IF(@OR(AB15 = 1,AB15 = 4),2300,
```

If this is true, then assign a value of $2300.00. The final part of this @IF statement could have just listed a value of $1700.00 (since conditions 1 through 4 are not true, then it must be condition 5, right?). We chose to list an additional @IF condition so that you can see it work. If filing status is equal to 3, then report $1700.00. If none of the conditions are true, then cell I49 will list a value of 0.00.

```
@IF(AB15 = 3,1700,0)))
```

Now, several @IF statements can easily be combined and allow you to do multiple tests within the same statement. That's what we call efficient.

The total amount deducted is then tabulated in cell I50. It is reported also on IRS line 34a, part 2 of Form 1040. See Table 4, cell AL4. This is, of course, where it should be. All that is required is an extra press or two of the recalculate key "!". But you may wish to wait until you enter the information on interest and dividends in FORM 1040.

Two things need to be said about this table. First, the values entered in this table are based on the sales tax in Florida for a family of four. If your family circumstances are different, or if your state has a different tax rate, make sure that you replace these data (column AO, rows 42 through 59) with the correct values. Secondly, if you have receipts for sales tax which are greater than the amount listed in this table, then replace the formula in cell AB18 with this receipt amount.

Schedule B

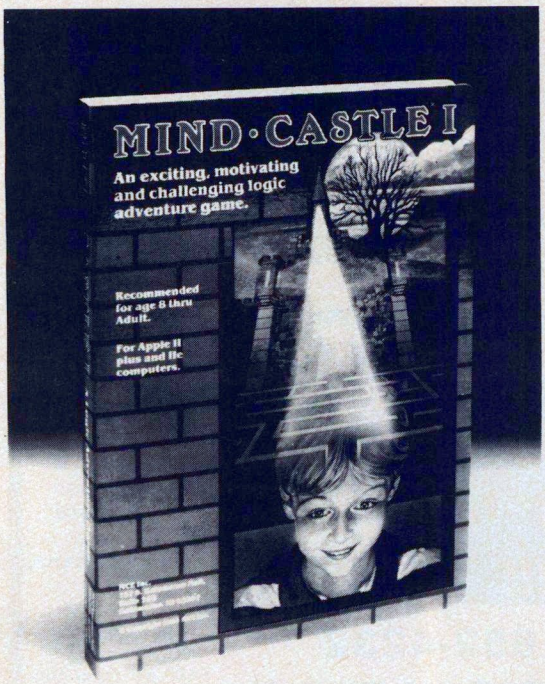
Schedule B is very straightforward and requires little comment here. Just enter all sources of Interest and Dividend income amounts in column R and their sources in the body of the table. Cell R27 will SUM all interest income, while cells R39 and R44 will compute the correct dividend income. Finally, you may wish to complete this table if you have foreign accounts and/or foreign trusts.

Of course, if you keyed in the data and are using the /GAP command, remember to assign new attributes to the appropriate cells.

Form 1040

Now, spend a couple of minutes and enter your name and address as well as social security number on rows four through six of columns V through AA. Once finished, take a moment and determine if you wish to contribute to the presidential campaign fund, then record your entry, if you wish. You may skip this step since you may have to use the actual 1040 form supplied by the IRS later.

Enter the number of your filing status in cell AB15 and list your exemptions in column AB, rows 17 through 27. Cell AB28 will automatically summate the total number of exemptions for you. By the way, Cells AB15 and AB28 will be used as references in determining which tax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schedule to use; make sure you have values in each of these cells.

Now take a few minutes and enter all the values for each source of income. Use rows 30 through 48 for these entries. Values for interest and dividend income should be displayed now. After all sources of income are entered, a press of ! will summate your gross income in cell AB50.

You might wish to enter easily computed adjustments to income, rows 52 through 62 now. In either case, pressing ! will yield a tentative value for Adjusted Gross Income—cell AB64. This value will appear also in cell AL3, which is normally the first line of the second page of Form 1040.

Completing Form 1040, Part 2

Part 2 of FORM 1040 is, to quote an old phrase, where the action is. (You might wish to take another look at Table 4 while following this discussion.) By now, cells AL3 and AL4 should present values other than zero. If not, or if you feel that the values are not correct, try pressing the recalculation key again. (Forward referencing can be a real pain!)

You might try using the brief worksheet listed in the instructions and enter the value in cell AL6. Our tax template will then find the larger of the differences and enter this value in cell AL7. The number of exemptions will be multiplied by $1,000, and this total will be entered in cell AL8. Your taxable income will be computed and reported in cell AL9 with a simple subtraction formula. (Go ahead and check it.) Your estimated tax will then be found with the use of the @IF and @LOOKUP functions in cell AL10.

TABLE 3. Form 1040--Individual Income Tax Return for 1984

	T	U	V	W	X	Y	Z	AA	AB	AC
1	1040		U.S. Indi	vidual Inc	ome Tax Re	turn 1984.				
2	=======	===	==========	==========	==========	==========	==========	==========	==========	
3			Name and	Address:			Social Sec	urity Num	ber	=
4										
5										
6										
7	=======	===	==========	==========	==========	==========	==========	=========	==========	
8	Presid.		Do you wan	t $1 to go	to this f	und?		Yes	No	
9	Camp'gn		Spouse?					Yes	No	
10	-------	---	----------	----------	----------	----------	----------	---------	----------	
11	Filing	1		Single						
12	Status	2		Married jo	int return					
13		3		Married se	parate ret	urn.	Spouses#		Enter fil-	
14		4		Head of ho	usehold				ing status	
15		5		Qualifying	widow(er)				below:VVVV	
16	-------	---	----------	----------	----------	----------	----------	---------	----------	
17	Exemp-	6a		Yourself		65 & over		Blind		
18	tions	6b		Spouse		65 & over		Blind		
19		6c	First nam	es of your	dependent	children	who live w	ith you.		
20			/AA	/AA				# child=>		
21		6d	Other dep	endents:						
22					Relation.	# months	Income of	Did you		
23			Name			liven in	>=$ 1,000	provide		
24						your home		>= 1/2 of		
25								support		
26										
27										
28		6e	Total num	ber of exe	mptions cl	aimed			@SUM(AB17.AB27)	
29	-------	---	----------	----------	----------	----------	----------	---------	----------	
30	Income	7	Wages, sa	laries, ti	ps, etc.				/AV	
31		8	Interest	income (al	so attach	Scedule B	if over $	400.	+R27	
32		9a	Dividends	$	+R44	9b. Excl	usions	$ 200.00	XXXXXXXXXX	
33		9c	Subtract	line 9b fr	om line 9a	and enter	results:		@IF((X32-AA32)<0,0,	
34		10	Refunds o	f State &	local inco	me taxes f	rom worksh	eet on	(X32-AA32))	
35			page 10 o	f instruct	ions.				XXXXXXXXXX	
36		11	Alimony r	eceived:						
37		12	Business	income or	(loss) (at	tach Sche	dule C)			
38		13	Capital g	ain or (lo	ss) (attac	h Schedule	D)			
39		14	40% capit	al gain di	stribution	not repor	ted in lin	e 13.		
40		15	Supplemen	tal gains	or (losses	) (attach	form 4797)			
41		16	Fully tax	able pensi	ons, IRA d	istributio	ns, and an	nuities		
42		17a	Other pen	sions and	annuities	including	rollover $		XXXXXXXXXX	
43		17b	Taxable a	mount, if	any, from	worksheet	on page 10			
44		18	Rents, ro	yalties, p	artnership	s, estates	, trusts,	etc.		
45		19	Farm inco	me or (los	s) (attach	Scedule F	)			
46		20a	Unemploym	ent compen	sation (in	surance).	Total rec$		XXXXXXXXXX	
47		20b	Taxable a	mount, if	any, from	worksheet-	page 11.			
48		21	Other inc	ome (state	nature an	d source-p	age 11).			
49										
50		22	TOTAL					$$$$$$$$$	@SUM(AB30.AB49)	
51	-------	---	----------	----------	----------	----------	----------	---------	----------	

	T	U	V	W	X	Y	Z	AA	AB
52	Adjust-	23	Moving ex	penses (Fo	rms 3903/3	903F)		$	XXXXXXXXXX
53	ments	24	Employee	business e	xpenses (F	orm2106)		$	XXXXXXXXXX
54	to	25a	IRA deduc	tion				$	XXXXXXXXXX
55	Income	25b	Enter IRA	payments	you made i	n 1984 tha	t are in-	XXXXXXXXX	XXXXXXXXXX
56			cluded in	line 25a	above -->		XXXXXXXXX$		XXXXXXXXXX
57		26	Payments	to Keogh (	H.R. 10) r	etirement	plan.	$	XXXXXXXXXX
58		27	Penalty o	n early wi	thdrawl of	savings.		$	XXXXXXXXXX
59		28	Alimony p	aid				$	XXXXXXXXXX
60		29	Deduction	for a mar	ried coupl	e when bot	h work (W)		XXXXXXXXXX
61		30	Disabilit	y income e	xclusion (	Form 2440)		$	XXXXXXXXXX
62		31	TOTAL adj	ustments				$$$$$$$$$	@SUM(AA52.AA61)
63	-------	---	----------	----------	----------	----------	----------	---------	----------
64	Adjust-	32	Subtract	line 31 fr	om line 22				+AB50-AB62
65	ed Inc.								

TABLE 4. Form 1040--Tax Computations

	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM
1			Form 1040	Page 2						
2	=======	===	==========	==========	==========	==========	==========	==========	==========	=
3	Tax	33	Amount fr	om line 32					+AB64	
4	Compu-	34a	Itemized	Schedule A	amount				+I50	
5	tations		Check her	e if you a	re claimed	as a depe	ndent:		XXXXXXXXXX	
6		34b	If you do	not itemi	ze deducti	ons, works	heet total	is:		
7		35	Subtract	line 34a o	r line 34b	from line	33.		@IF(AL4>AL6,	
									(AL3-AL4),(AL3-AL6))	
8		36	Multiply	$1,000 by	the number	of exempt	ions in li	ne 6e	1000*AB28	
9		37	Taxable i	ncome. sub	tract line	36 from l	ine 35.		+AL7-AL8	
10		38	Tax from:	tax rate s	chedule X,	Y, or Z o	r schedule	G.	@IF(AB15=1,@LOOKUP(AL9,AN5.AN20),	
									@IF(@OR(AB15=2,AB15=5),	
									@LOOKUP(AL9,AQ5.AQ19),	
									@IF(@OR(AB15=3,@LOOKUP(AL9,AN23.AN37),	
									@LOOKUP(AB74,AW23.AQ37))))	
11		39	Additiona	l Taxes:	Form No.:					
12		---	----------	----------	----------	----------	----------	---------	----------	
13		40	TOTAL						+AL10+AL11	
14	-------	---	----------	----------	----------	----------	----------	---------	----------	
15	Credits	41	Credits f	or child c	are:			$	XXXXXXXXXX	
16		42	Credits f	or elderly	and disabl	ed:		$	XXXXXXXXXX	
17		43	Residenti	al energy	credit:			$	XXXXXXXXXX	
18		44	Partial c	redit for	political	contribu.		$	XXXXXXXXXX	
19		45	TOTAL per	sonal cred	its			$$$$$$$$$	@SUM(AK15.AK18)	
20		46	Subtract	line 45 fr	om 40:			$	@IF((AL13-AL19)>0,(AL13-AL19),0)	
21		47	Foreign T	ax credit:				$	XXXXXXXXXX	
22		48	General B	usiness cr	edit:			$	XXXXXXXXXX	
23		49	Add lines	47 & 48:				$$$$$$$$$	+AK21+AK22	
24		50	Balance						@IF((AL20-AL23)>0,AL20-AL23,0)	
25	-------	---	----------	----------	----------	----------	----------	---------	----------	
26	Other	51	Self-empl	oyment tax	(Form SE)			$		
27	Taxes	52	Alternati	ve minimum	tax (Form	6251)		$		
28		53	Tax from	recaptured	investmen	t credit	(Form 4255	$		
29		54	Social Se	curity Tax	on tip in	come not r	eported to	employer		
30		55	Tax on an	IRA (Form	5329)			$		
31										
32		---	----------	----------	----------	----------	----------	---------		
33		56	TOTAL TAX						@SUM(AL24.AL32)	
34	-------	---	----------	----------	----------	----------	----------	---------	----------	
35	Payment	57	Federal In	come tax w	ithheld			$	XXXXXXXXXX	
36		58	1984 esti	mated tax	payments			$	XXXXXXXXXX	
37		59	Earned inc	ome credit				$	XXXXXXXXXX	
38		60	Amount pai	d with For	m 4868			$	XXXXXXXXXX	
39		61	Excess soc	ial securi	ty tax & R	RTA tax		$	XXXXXXXXXX	
40		62	Credit for	federal t	ax on fuel	s & oils		$	XXXXXXXXXX	
41		63	Regulated	Investment	Company c	redit		$	XXXXXXXXXX	
42		--	----------	----------	----------	----------	----------	---------	----------	
43		64	TOTAL PAYM	ENTS				$$$$$$$$$	@SUM(AK35.AK41)	
44	-------	---	----------	----------	----------	----------	----------	---------	----------	

	AD	AE	AF	AG	AH	AI	AJ	AK	AL
45	Refund	65	If line 64	is larger	than 56,	overpaid.		$$$$$$$$$	@IF(AL43>AL33,AL43-AL33,0)
46	Amount	66	Amount of	line 65 to	be refund	ed to you		$$$$$$$$$	
47	You Owe	67	Amount of	line 65 to	be applie	d to 1984	estim. tax	ENTER $	
48		68	Amount you	owe				$$$$$$$$$	@IF(AL33>AL43,AL33-AL43,0)
49	-------	---	----------	----------	----------	----------	----------	---------	----------
50	Please								
51	Sign								
52	Here								
53	-------	---	----------	----------	----------	----------	----------	---------	----------
54	Paid								
55	Prepar-								
56	er Use								
57	*******	***	**********	**********	**********	**********	**********	*********	**********

```
@IF(AB15=1,@LOOKUP(AL9,AN5...AN20),
 @IF(@OR(AB15=2,AB15=5),
  @LOOKUP(AL9,AQ5...AQ19),
   @IF(AB15=3,@LOOKUP
    (AL9,AN23...AN37),
     @LOOKUP(AB74,AQ23...AQ37))))
```

This follows the traditional approach of first determining your stated filing status (i.e., cell AB15), then using the appropriate tax rate schedule to determine your basic taxes. Take a minute or two and study it. It really isn't too tough.

You might also wish to look at the LOOKUP tables listed in columns AN through AR. For Schedule X, we used actual values to compute tax liability; while in Schedule Y, we referenced appropriate cells. This will give you two ways to develop a tax table, or, for that matter, any LOOKUP table. Take a few minutes and study the table and the template.

When finished, go ahead an enter any additional taxes, credits or payments you have either had withheld or made to the IRS previously. Cells AL45 and AL48 will report either the amount that you have overpaid or the amount you owe to the IRS. For cell AL45 the following @IF statement is used:

```
@IF(AL43>AL33,AL43-AL33,0)
```

while for cell AL48, the following is used:

```
@IF(AL33>AL43,AL33-AL43,0)
```

Remember to press the recalculation key several times. Perhaps the safest approach is to place the marker in column AL. When the values in this column stop changing, then you can be assured that all the computations have been completed and the correct values were referenced. Now, save your worksheet.

Printing

For those of you who have been wondering why the column widths seemed so strange, well, here it is. First, for some of the tax forms, space for several possible entries on the same line had to be reserved. This was less of a problem than making sure that all the completed tables would fit on standard 80 column paper. If you place your marker in cell B1—that's B1, not A1—give the command to /Print, and each Form will be printed on its own page. This will make your accountant very happy.

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TABLE 5. Look-up Tables Using Alternate Tax Rates

	AN	AO	AP	AQ	AR
1	Look-up ta	bles --tax	rate	sche	dules
2	----------	----------	------	----------	----------
3	Schedule X	--Single-1		Schedule Y	--Mar 2&5
4	----------	----------		----------	----------
5	0.00	0.00		0.00	0.00
6	2300.00	+AL9-2300*.11		3400.00	+AL9-AQ6*.11
7	3400.00	121+((AL9-3400*.12))		5500.00	231+(AL9-AQ7*.12)
8	4400.00	241+(AL9-4400*.14)		7600.00	483+(AL9-AQ8*.14)
9	6500.00	535+(AL9-6500*.15)		11900.00	1085+(AL9-AQ9*.16)
10	8500.00	835+(AL9-8500*.16)		16000.00	1741+(AL9-AQ10*.18)
11	10800.00	1203+(AL9-10800*.18)		20200.00	2497+(AL9-AQ11*.22)
12	12900.00	1581+(AL9-12900*.2)		24600.00	3465+(AL9-AQ12*.25)
13	15000.00	2001+(AL9-15000*.23)		29900.00	4790+(AL9-AQ13*.28)
14	18200.00	2737+(AL9-18200*.26)		35200.00	6274+(AL9-AQ14*.33)
15	23500.00	4115+(AL9-23500*.3)		45800.00	9772+(AL9-AQ15*.38)
16	28800.00	5705+(AL9-28800*.34)		60000.00	15168+(AL9-AQ16*.42)
17	34100.00	7507+(AL9-34100*.38)		85600.00	25920+(AL9-AQ17*.45)
18	41500.00	10319+(AL9-41500*.42)		109400.00	36630+(AL9-AQ18*.49)
19	55300.00	16115+(AL9-55300*.48)		162400.00	62600+(AL9-AQ19*.5)
20	81800.00	28835+(AL9-81800*.5)			
21	Schedule Y	--Mar. 3		Schedule Z	--Head 4
22	----------	----------		----------	----------
23	0.00	0.00		0.00	0.00
24	1700.00	+AL9-AN24*.11		2300.00	+AL9-AQ24*.11
25	2750.00	115.5+(AL9-AN25*.12)		4400.00	231+(AL9-AQ25*.12)
26	3800.00	241.5+(AL9-AN26*.14)		6500.00	483+(AL9-AQ26*.14)
27	5950.00	542.5+(AL9-AN27*.16)		8700.00	791+(AL9-AQ27*.17)
28	8000.00	870.5+(AL9-AN28*.18)		11800.00	1318+(AL9-AQ28*.18)
29	10100.00	1248.5+(AL9-AN29*.22)		15000.00	1894+(AL9-AQ29*.2)
30	12300.00	1732.5+(AL9-AN30*.25)		18200.00	2534+(AL9-AQ30*.24)
31	14950.00	2395+(AL9-AN31*.28)		23500.00	3806+(AL9-AQ31*.28)
32	17600.00	3137+(AL9-AN32*.33)		28800.00	5290+(AL9-AQ32*.32)
33	22900.00	4886+(AL9-AN33*.38)		34100.00	6986+(AL9-AQ33*.35)
34	30000.00	7584+(AL9-AN34*.42)		44700.00	10696+(AL9-AQ34*.42)
35	42800.00	12960+(AL9-AN35*.45)		60600.00	17374+(AL9-AQ35*.45)
36	54700.00	18315+(AL9-AN36*.49)		81800.00	26914+(AL9-AQ36*.48)
37	81200.00	31300+(AL9-AN37*.5)		108300.00	39634+(AL9-AQ37*.5)
38					

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40	Sales Tax	Table
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42	0.00	123.00
43	8001.00	146.00
44	10001.00	168.00
45	12001.00	189.00
46	14001.00	210.00
47	16001.00	229.00
48	18001.00	248.00
49	20001.00	267.00
50	22001.00	285.00
51	24001.00	302.00
52	26001.00	319.00
53	28001.00	336.00
54	30001.00	353.00
55	32001.00	369.00
56	34001.00	385.00
57	36001.00	400.00
58	38001.00	415.00
59	40001.00	@IF(AL3>100000, 415+(100000-40000)/5000*21, (415+((@INT((AL3-40000)/5000)+1)*21)))

CORRECTION FOR "SuperCalc 3a" REVIEW

There is an error in the SuperCalc3a review published in the November 1985 issue, page 36. In the second column, the formula in bold type should read:

A1 + B1 * C1

Conclusion

With the end of the year approaching, you still have time to determine what you can do to make an impact on your tax liability. These templates have been provided to help you make the right choice. So, go ahead and download the templates or key in the labels and formulae. Then try several scenarios, and note the solution that is best for you. Just remember, when dealing with forward referencing and THE Spreadsheet, press the recalculation key ! several times.

In possible upcoming *Spreadsheet Sheet* articles we are planning discussions on using spreadsheet software for real time applications, public policy and planning issues, building exec/execute files, and useful hints when building templates. If you have some application that you would like to see examined in this column, drop me a line at:

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%Call -A.P.P.L.E.
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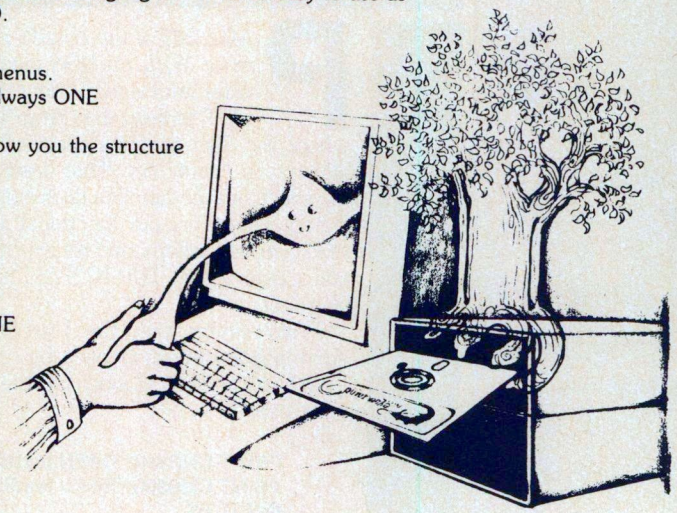

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ProDOS Input Anything Routine

Ken Kashmarek

PAGE 207 of the *BASIC Programming With ProDOS* manual provides information about using INPUT to read data from text files where the data contains commas, colons, and return characters. That description is incorrect and the function does not work as stated. However, the functional ability to read commas, colons, and return characters still exists within BASIC.SYSTEM (Version 1.1).

Very simply put, the ProDOS Input Anything Routine is invoked by coding the length parameter (Lxxx) on the READ statement:

```
PRINT CHR$(4);"OPEN textfile"
PRINT CHR$(4);"READ textfile,L100"
INPUT A$
```

Use of the length parameter in this fashion is not documented in the manual. The variable A$ will receive the next 100 characters from textfile, including commas, colons, and return characters. The last INPUT operation to the file may receive less than 100 characters. The maximum value that may be coded for L is 238. The data is passed from BASIC.SYSTEM to Applesoft as a quoted string in page 2 of memory. This is the keyboard input buffer area. A quote ($22) is placed at $200, followed by the number of characters indicated by L (in this

Listing 1—Sample Program and Output

```
100 REM
    DEMONSTRATE PRODOS INPUT
    ANYTHING ROUTINE.
110 DIM L(20)
120 D$ = CHR$ (4)
130 F$ = "TEST.FILE"
140 PRINT D$"OPEN";F$
150 PRINT D$"WRITE";F$
160 PRINT "ABC,DEF,:HIG:DDDDDD,,::"
170 PRINT "AN OUTPUT LINE, AND
    RETURN"
180 PRINT "ANOTHER LINE WITH
    RETURN,"
190 PRINT "AND: ANOTHER LINE."
200 PRINT
210 PRINT
220 PRINT "AND THE LAST LINE:::,,,"
230 PRINT "XXX"; CHR$ (34);"YYY"
240 PRINT D$"CLOSE";F$
250 PRINT
    "----------------."
260 K = 0
270 ONERR GOTO 350
280 PRINT D$"READ"F$",TTXT"
290 PRINT D$"READ"F$",L50"
300 K = K + 1
310 INPUT A$
320 PRINT A$;
330 L(K) = LEN (A$)
340 GOTO 290
350 POKE 216,0
360 PRINT A$;
370 L(K) = LEN (A$)
380 PRINT D$"CLOSE"F$
390 PRINT
400 PRINT
    "----------------."
410 PRINT "NUMBER OF INPUTS = ";K
420 PRINT "LENGTH OF INPUTS = ";
430 FOR I = 1 TO K
440 PRINT L(I);" ";
450 NEXT

]RUN

----------------.
ABC,DEF,:HIG:DDDDDD,,::
AN OUTPUT LINE, AND RETURN
ANOTHER LINE WITH RETURN,
AND: ANOTHER LINE.

AND THE LAST LINE:::,,,
XXX
----------------.
NUMBER OF INPUTS = 3
LENGTH OF INPUTS = 50 50 25
```

Figure 1—Output From TYPE Command

```
]TYPE TEST.FILE
ABC,DEF,:HIG:DDDDDD,,::
AN OUTPUT LINE, AND RETURN
ANOTHER LINE WITH RETURN,
AND: ANOTHER LINE.


AND THE LAST LINE:::,,,
XXX"YYY
```

example, 100), another quote, and a carriage return. Applesoft accepts the data since it is a quoted string. The string length of 238 bytes is an Applesoft restriction for the amount of data handled through the input buffer (INPUT statement or program line).

The sample program (Listing 1) illustrates the use of this feature. It first creates a text file with colons, commas, and return characters. The file is then read using L50 and the data displayed. Figure 1 is the output of the file from a TYPE command, while Figure 2 is the output from a DUMP command. By the way, page 226-227 in the manual documents reading directory files with Applesoft. This same feature is used to pass the formatted directory entry data back to Applesoft as a quoted string in the input buffer (the 79 character directory data contains colons in the time values). As an experiment, rerun the program without L100 on the READ (line 290). This will show you the output when Applesoft sees all of the commas, colons, and return characters.

Note that this technique is still imperfect. Line 230 puts out a quote character (") as CHR$(34). This quote terminates a quoted string and some of the data cannot be read. This data does show up when displayed with a TYPE command or DUMP command. In addition to terminating the string when a quote is detected, Applesoft also terminates the string when $00 is detected. Thus, you cannot read a file using this technique if the file contains null bytes ($00 values except at the end). This severely limits a significant ability provided by BASIC.SYSTEM: use of OPEN, CLOSE, READ, and WRITE to process any file type.

Figure 2—Output From DUMP Command

```
]DUMP TEST.FILE
$0000:41  42 43 2C 44 45 46 2C ABC,DEF,
$0008:3A  48 49 47 3A 44 44 44 :HIG:DDD
$0010:44  44 44 2C 2C 3A 3A 0D DDD,,::.
$0018:41  4E 20 4F 55 54 50 55 AN OUTPU
$0020:54  20 4C 49 4E 45 2C 20 T LINE,
$0028:41  4E 44 20 52 45 54 55 AND RETU
$0030:52  4E 0D 41 4E 4F 54 48 RN.ANOTH
$0038:45  52 20 4C 49 4E 45 20 ER LINE
$0040:57  49 54 48 20 52 45 54 WITH RET
$0048:55  52 4E 2C 0D 41 4E 44 URN,.AND
$0050:3A  20 41 4E 4F 54 48 45 : ANOTHE
$0058:52  20 4C 49 4E 45 2E 0D R LINE..
$0060:0D  0D 41 4E 44 20 54 48 ..AND TH
$0068:45  20 4C 41 53 54 20 4C E LAST L
$0070:49  4E 45 3A 3A 3A 2C 2C INE:::,,
$0078:2C  0D 58 58 58 22 59 59 ,.XXX"YY
$0080:59  0D                  Y.
```

How It Works

When the length parameter is coded on the READ command, a ProDOS NewLine MLI call ($C9) changes the enable mask for file processing. Ordinarily, the enable mask at location $BED3 in the BASIC.SYSTEM global page is set to $7F. This activates use of the newline character at location $BED4 as an input terminator. This location usually contains $0D. When the length parameter is coded, the enable mask is set to $00 which disables newline mode. Thus, the length parameter determines how many characters are passed back for each INPUT. All of the characters read from the file are passed back via the keyboard input buffer, but Applesoft terminates the string when it finds $00 or $22. If your application deals with files that do not contain these bytes, the length operand on the READ statement will work very nicely. It may be just as easy to code an ampersand routine to handle this situation.

Acknowledgement:

This information was passed along from Apple Computer, Inc. when I reported a problem with BASIC.SYSTEM using comma tabbing for output to a disk file (more about this some other time). During the discussion, I learned how to use the Input Anything feature that was incorrectly documented on page 207 of the BASIC Programming With ProDOS *manual. After receiving this information, I contacted Cecil Fretwell who checked out the code, determined that it used the quoted string technique, and pointed out the character string length limitation.*

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	TLOAD	6.2	NO	NO
(791 Strings, 32 chars ea)	WRITE	29.3	28.0	88.4
	READ	24.3	16.3	83.8
	PRINT/READ	44.2	45.9	117.1
(442 Sectors, 7 x 500)	APPEND	142.3	142.9	1231.2
APPLESOFT (100 Sectors)	*SAVE	6.4	16.4	33.1
	LOAD	5.0	4.0	23.5
INTEGER (100 Sectors)	*SAVE	6.6	NO	33.4
	LOAD	4.9	NO	23.4
BINARY (100 Sectors)	*BSAVE	7.3	18.4	28.7
	BLOAD	5.8	4.8	24.5
48K PROGRAM SPACE (With 3 Bufs avail)	APPLESOFT	36,352	NO	36,352
	INTEGER	36,352	NO	36,352
	BINARY	36,352	34,816	36,352
64K PROGRAM SPACE (With 4 Bufs avail)	APPLESOFT	46,592	32,256	35,756
	INTEGER	46,592	NO	35,756
	BINARY	46,592	41,728	35,756

*Add 5 seconds for Verify. Apple II, Applesoft & ProDOS are trademarks of Apple

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3. DATE stamp files. Clock or manual dating.
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5. TSAVE speed saves Text Files from memory.
6. TLIST lists all Text Files to screen/printer.
7. DUMP Binary/Ascii to screen or printer.
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The Graphics Toolkit Part 6

Randi J. Rost

THE development of a shape-making utility program in the last column has paved the way for this installment's topic—a machine-language routine for drawing block shapes. Part 5 (in the June 1985 issue) discussed the goals of our shape-drawing efforts and the motivation for the design of the shape table. Go back and reread that article if it's still a little fuzzy. Use the MAT program to make a shape of your own, because now we're going to animate it!

Algorithm Overview

The algorithm presented here to draw block shapes is actually fairly trivial. The 6502's 8-bit arithmetic and the Apple's complicated graphics memory organization work together to bury the algorithm under a mountain of unpleasant details. For that reason, we'll first look at the high-level algorithm. Then we'll discuss the implementation details as we go through the shape-drawing routine line by line.

The shape-drawing routine will expect three input values: x-position (high and low bytes), y-position, and the number of the shape to be drawn. The first step is to calculate a pointer to the shape data, given only the shape number and a pointer to the start of the shape table. We'll adopt the convention that the first shape in the table will be referred to as shape #1 and not shape #0.

You'll recall that the shape table starts with a byte containing the number of shapes in the table, two bytes representing an offset to the next available memory location, and then a series of two-byte offsets to shapes, one for each shape in the table. We can calculate a pointer to the offset for shape n by adding 2*n + 1 to the starting address of the shape table. This offset will be read and added to the current pointer value, resulting in a pointer to the first byte of shape data for shape #n.

Now recall that each shape contains a width (in bytes), a height (in pixels), two-byte offsets for each of the seven frames in the shape, and then the actual data for each of the seven frames. The width and height will be used as the loop boundaries for a two-dimensional transfer loop.

We must now calculate the frame number of the shape that should be used,

given the x-coordinate where the shape is to be drawn. For x = 0 or 1, we should use frame #1, for x = 2 or 3 we'll use frame #2, and so on until we get to frame #7 when x = 12 or 13. For x = 14 or 15, we'll use frame #1 again, moved over two bytes. The formula for the frame number to use is FRAME = (X/2) MOD 7 + 1. Funny thing. Way back in Part 1, we included a lookup table to compute MOD 7 values! At last we get to use it!

Once we have computed which frame to use, we can multiply the frame number by two and add the result to our pointer. This leaves us pointing at the two-byte offset for the desired frame. We can add this two-byte offset to the pointer to arrive at the start of the actual data for the desired frame.

The rest is easy. We simply set up a nested loop to transfer data from rows and columns in our shape table to rows and columns on the graphics screen.

Implementation Details

Listing 1 shows the machine-language implementation of the algorithm discussed above. Let's examine some of the gory details.

The first thing you might notice is that the routine has two entry points. This allows the routine to serve two purposes. Sometimes we'll want to replace whatever is on the screen with data from the shape table. This is what happens when the DRAW entry point is used. Other times we'll want to exclusive-or the shape data with whatever is on the screen. The XDRAW entry point can be used to do this. XDRAWing a shape a second time in the same position will erase it, leaving the screen contents unaffected.

The first order of business for both DRAW and XDRAW is to store the registers away for later use. Then, in each case, the controversial, but sometimes useful technique of self-modifying code is used to "create" the difference between DRAW and XDRAW. The only difference between the two routines is that XDRAW requires an extra instruction in the actual transfer loop to exclusive-or the current contents of the screen with the shape data before storing the result to the screen. The XDRAW entry point causes the 6502 EOR instruction to be stored at the appropriate location in the transfer loop, and the DRAW entry point causes two NOP instructions to be stored there. Actually, there are two such transfer loops that must be modified. The second one will appear in a subroutine to draw shapes that are only partially within the graphics window in the next column.

What are the advantages of self-modifying code in this case? We saved a few bytes of storage and perhaps made our transfer loop an instruction or two shorter (faster). The price? We made the source code more difficult to understand, we ruled out the possibility of ROM implementations, and debugging is harder. Since the

Listing 1

```
:ASM
                        1    *
                        2    *  DRAW AND XDRAW ARE USED TO DRAW ANIMATION (BLOCK)
                        3    *  SHAPES.  MAKE SURE SHPTABL CONTAINS A POINTER TO
                        4    *  A VALID SHAPE TABLE AND PASS THE NUMBER OF THE
                        5    *  SHAPE TO BE DRAWN IN $09 AND THE POSITION OF THE
                        6    *  UPPER LEFT CORNER OF THE SHAPE IN THE REGISTERS
                        7    *  WITH XLO IN X, XHI IN A AND Y IN THE Y REGISTER.  DRAW
                        8    *  CAUSES SHAPE DATA TO OVERWRITE THE CONTENTS OF HI-RES
                        9    *  MEMORY.  XDRAW EXCLUSIVE OR'S SHAPE DATA WITH THE
                        10   *  CONTENTS OF SCREEN MEMORY - XDRAWING A SHAPE WILL
                        11   *  DISPLAY IT, XDRAWING IT AGAIN WILL ERASE IT, LEAVING
                        12   *  THE HI-RES SCREEN UNAFFECTED.
                        13   *
                        14            ORG   $AFE
                        15   XLOCLO   EQU   $06
                        16   XLOCHI   EQU   $07
                        17   YLOC     EQU   $08
                        18   SHPNO    EQU   $09
                        19   HGADRLO  EQU   $1E
                        20   HGADRHI  EQU   $1F
                        21   HGRPG    EQU   $E6
                        22   YTABL    EQU   $EC
                        23   YTABH    EQU   $EE
                        24   SHPTABL  EQU   $FA
                        25   SHPBASL  EQU   $FC
                        26   SHPBASH  EQU   $FD
                        27   FRMBASL  EQU   $D4
                        28   FRMBASH  EQU   $D5
                        29   XDIVTBL  EQU   $4C
                        30   XMODTBL  EQU   $D0
                        31   TEMPPTR2 EQU   $D2
                        32   WNDWTOP  EQU   $A6A
                        33   WNDWBOT  EQU   $A6B
                        34   WNDWRLO  EQU   $A6C
                        35   WNDWRHI  EQU   $A6D
                        36   WNDWLLO  EQU   $A6E
                        37   WNDWLHI  EQU   $A6F
                        38   DEORLOC2 EQU   $D8F
                        39   XBYTE    DS    1
                        40   XDIV2    DS    1
                        41   HEIGHT   DS    1
                        42   WIDTH    DS    1
                        43   DTEMPX   DS    1
                        44   DTEMPY   DS    1
                        45   BOTTOMY  DS    1
0B05: 85 07             46   STOREREG STA   XLOCHI
0B07: 86 06             47            STX   XLOCLO
0B09: 84 08             48            STY   YLOC
0B0B: 60                49            RTS
0B0C: 20 05 0B          50   DRAW     JSR   STOREREG    ;SAVE SHAPE POSITION FOR LATER
0B0F: A9 EA             51            LDA   #$EA
0B11: 8D 44 0C          52            STA   DEORLOC     ;STORE NOPS IF
0B14: 8D 45 0C          53            STA   DEORLOC+1   ;DRAW ENTRY PT USED
0B17: 8D 8F 0D          54            STA   DEORLOC2

0B1A: 8D 90 0D          56            STA   DEORLOC2+1
0B1D: 30 13             57            BMI   DSTART
0B1F: 20 05 0B          58   XDRAW    JSR   STOREREG
0B22: A9 51             59            LDA   #$51
0B24: 8D 44 0C          60            STA   DEORLOC     ;STORE EOR IF XDRAW
0B27: 8D 8F 0D          61            STA   DEORLOC2    ;ENTRY PT IS USED
0B2A: A9 1E             62            LDA   #$1E
0B2C: 8D 45 0C          63            STA   DEORLOC+1
0B2F: 8D 90 0D          64            STA   DEORLOC2+1
0B32: A5 09             65   DSTART   LDA   SHPNO       ;LOAD SHAPE #
0B34: 0A                66            ASL               ;MULTIPLY BY 2
0B35: A8                67            TAY               ;STORE IN Y
0B36: C8                68            INY               ;ADD 1
0B37: 98                69            TYA
0B38: 18                70            CLC
0B39: 71 FA             71            ADC   (SHPTABL),Y ;LOAD SHAPE OFFSET LO
0B3B: 85 FC             72            STA   SHPBASL     ;STORE IT IN SHAPE BASE PTR
0B3D: C8                73            INY
0B3E: B1 FA             74            LDA   (SHPTABL),Y ;LOAD SHAPE OFFSET HI
0B40: 65 FB             75            ADC   SHPTABL+1   ;ADD START ADR HI OF TABLE
0B42: 85 FD             76            STA   SHPBASH     ;STORE SHAPE BASE ADR HI
0B44: 18                77            CLC
0B45: A5 FC             78            LDA   SHPBASL     ;LOAD SHAPE OFFSET LO
0B47: 65 FA             79            ADC   SHPTABL     ;ADD START ADR LO
0B49: 85 FC             80            STA   SHPBASL     ;STORE SHAPE BASE ADR LO
0B4B: A9 00             81            LDA   #$00        ;ADD CARRY
0B4D: 65 FD             82            ADC   SHPBASH     ;TO HIGH BYTE
0B4F: 85 FD             83            STA   SHPBASH
0B51: A0 00             84            LDY   #$00
0B53: B1 FC             85            LDA   (SHPBASL),Y ;GET SHAPE WIDTH
0B55: 8D 01 0B          86            STA   WIDTH
0B58: C8                87            INY
0B59: B1 FC             88            LDA   (SHPBASL),Y ;GET SHAPE HEIGHT
0B5B: 8D 00 0B          89            STA   HEIGHT
                        90   * CHECK TO SEE IF ANY PART OF SHAPE
                        91   * WILL BE OFF THE PRE-DEFINED WINDOW
0B5E: 18                92            CLC               ;CHECK IF SHAPE EXCEEDS
0B5F: A5 08             93            LDA   YLOC        ;TOP OF WINDOW. IF
0B61: C9 C0             94            CMP   #$C0        ;SEE IF Y < 0
0B63: 90 03             95            BLT   CONTO
0B65: 4C 68 0C          96            JMP   DRAWPART    ;JUMP TO PARTIAL DRAW
```

routine is already debugged (I hope!), only the first two are issues. Oh well. Here, speed and compactness are more desirable than understandability when a choice has to be made.

The routine now proceeds to build up a pointer to the shape data in the sequence described above. Lines 65-68 compute SHAPE*2+1, and this value is added to the pointer in lines 69-76. Next the offset to the desired shape is read and added to the pointer (lines 77-83), giving us a pointer to the start of the desired shape definition.

The width and height of the shape are now read and stored for later use. We can now determine whether any portion of the shape is outside the current graphics window. If so, we'll jump to the routine DRAWPART. For now, DRAWPART is simply a return so that no shape will be drawn unless it is entirely within the window.

I also wanted to be able to specify negative values for X and Y so that shapes can be scrolled completely off the screen. For Y, I decided that values of 0-191 would indicate positive Y values and values from 192 to 255 would be used to represent Y values from -64 to -1. X-coordinates with a high-byte of $FF will also be interpreted as negative values. For instance, passing the values $FE, $FF, and $FE in the Y, A, and

```
0B68: CD 6A 0A  97  CONTO   CMP  WNDWTOP     ;YLOC >= WNDWTOP THEN
0B6B: B0 03     98          BGE  CONT1      ;CONTINUE CHECK,
0B6D: 4C 68 0C  99          JMP  DRAWPART   ;ELSE JUMP TO PARTIAL DRAW
0B70: 18        100 CONT1   CLC
0B71: 6D 00 0B  101         ADC  HEIGHT     ;CHECK IF SHAPE EXCEEDS
0B74: CD 6B 0A  102         CMP  WNDWBOT    ;BOTTOM OF WINDOW. IF
0B77: F0 05     103         BEQ  CONT1B     ;YLOC+HEIGHT <=WNDWBOT
0B79: 90 03     104         BLT  CONT1B     ;THEN CONTINUE CHECK
0B7B: 4C 68 0C  105         JMP  DRAWPART   ;ELSE JUMP TO PARTIAL DRAW
0B7E: A5 07     106 CONT1B  LDA  XLOCHI
0B80: C9 FF     107         CMP  #$FF       ;IF XHI = -1, SHP IS OFFSCREEN
0B82: D0 03     108         BNE  CONT2
0B84: 4C 68 0C  109         JMP  DRAWPART   ;JUMP TO PARTIAL DRAW
0B87: A5 06     110 CONT2   LDA  XLOCLO
0B89: 85 D2     111         STA  TEMPPTR2   ;STORE X'S FOR FUTURE USE
0B8B: A5 07     112         LDA  XLOCHI
0B8D: 85 D3     113         STA  TEMPPTR2+1 ;CHECK IF SHAPE EXCEEDS
0B8F: CD 6F 0A  114         CMP  WNDWLHI    ;LEFT EDGE. IF XLOCHI=WNDWLHI
0B92: F0 05     115         BEQ  CONT3      ;WE MUST CHECK LO BYTE.
0B94: B0 0D     117         BGE  CONT4      ;IF XLOCHI>WNDWLHI, CONT.
0B96: 4C 68 0C  118         JMP  DRAWPART   ;ELSE JUMP TO PARTIAL DRAW
0B99: A5 06     119 CONT3   LDA  XLOCLO     ;CHECK LEFT EDGE LO BYTE
0B9B: CD 6E 0A  120         CMP  WNDWLLO    ;COORD WHEN HI BYTES =
0B9E: B0 03     121         BGE  CONT4      ;CONTINUE IF XLOCLO>=WNDWLLO
0BA0: 4C 68 0C  122         JMP  DRAWPART   ;ELSE JUMP TO PARTIAL DRAW
0BA3: AD 01 0B  123 CONT4   LDA  WIDTH      ;ADD WIDTH TO LEFT
0BA6: 0A        124         ASL             ;EDGE COORDINATE
0BA7: 0A        125         ASL             ;(WIDTH IS IN BYTES, SO MUST
0BA8: 0A        126         ASL             ;MULT BY 8 TO GET WIDTH IN PIXELS)
0BA9: 18        127         CLC
0BAA: 65 D2     128         ADC  TEMPPTR2   ;STORE COMPUTED RIGHT EDGE
0BAC: 85 D2     129         STA  TEMPPTR2   ;(IN PIXELS) IN TEMPPTR2
0BAE: 90 02     130         BCC  CONT5
0BB0: E6 D3     131         INC  TEMPPTR2+1
0BB2: 18        132 CONT5   CLC
0BB3: A5 D3     133         LDA  TEMPPTR2+1 ;CHECK IF SHAPE EXCEEDS
0BB5: CD 6D 0A  134         CMP  WNDWRHI    ;RIGHT EDGE
0BB8: F0 05     135         BEQ  CONT6      ;BR TO CONT6 IF XRTHI=WNDWRHI
0BBA: 90 0F     136         BLT  CONT7      ;IF XRTHI<WNDWRHI CONTINUE
0BBC: 4C 68 0C  137         JMP  DRAWPART   ;ELSE JUMP TO PARTIAL DRAW
0BBF: A5 D2     138 CONT6   LDA  TEMPPTR2   ;CHECK LO BYTES WHEN HI ARE =
0BC1: CD 6C 0A  139         CMP  WNDWRLO    ;IF XRTLO<=WNDWRLO, SHAPE
0BC4: F0 05     140         BEQ  CONT7      ;IS WITHIN WINDOW
0BC6: 90 03     141         BLT  CONT7
0BC8: 4C 68 0C  142         JMP  DRAWPART   ;ELSE JUMP TO PARTIAL DRAW
0BCB: A5 4C     143 CONT7   LDA  XDIVTBL
0BCD: 85 D2     144         STA  TEMPPTR2   ;GET PTRS TO X/7 TABLE
0BCF: A5 4D     145         LDA  XDIVTBL+1
0BD1: 85 D3     146         STA  TEMPPTR2+1
0BD3: A5 07     147         LDA  XLOCHI     ;IF X>255
0BD5: F0 02     148         BEQ  LT256A3    ;INCREMENT TEMPPTR
0BD7: E6 D3     149         INC  TEMPPTR2+1
0BD9: A4 06     150 LT256A3 LDY  XLOCLO     ;LOAD INDEX TO TABLE
0BDB: B1 D2     151         LDA  (TEMPPTR2),Y ;LOAD VALUE FOR X/7
0BDD: 4A        152         LSR             ;MAKE SURE WE HAVE
0BDE: 0A        153         ASL             ;AN EVEN-NUMBERED BYTE
0BDF: 8D FE 0A  154         STA  XBYTE      ;STORE RESULT IN XBYTE
0BE2: A5 D0     155         LDA  XMODTBL
0BE4: 85 D2     156         STA  TEMPPTR2   ;GET PTRS TO
0BE6: A5 D1     157         LDA  XMODTBL+1  ;(X MOD 7) + 1 TABLE
0BE8: 85 D3     158         STA  TEMPPTR2+1
0BEA: A5 06     159         LDA  XLOCLO     ;DIVIDE BY 2 TO GET RESOLUTION
0BEC: 4A        160         LSR             ;IN THE RANGE 0-139
0BED: 8D FF 0A  161         STA  XDIV2
0BF0: A5 07     162         LDA  XLOCHI     ;ADD #$80 TO ABOVE RESULT IF
0BF2: C9 00     163         CMP  #$00       ;HI PART EQUALS 1
0BF4: F0 02     164         BEQ  LT256A5
0BF6: A9 80     165         LDA  #$80
0BF8: 6D FF 0A  167 LT256A5 ADC  XDIV2
0BFB: A8        168         TAY
0BFC: 88        169         DEY             ;NOW HAVE CORRECT INDEX TO XMODTBL
0BFD: B1 D2     170         LDA  (TEMPPTR2),Y ;LOAD VALUE FOR (X MOD 7)+1
0BFF: 0A        171         ASL             ;MULTIPLY BY 2 TO GET
0C00: A8        172         TAY             ;PROPER OFFSET FOR DESIRED FRAME
0C01: 18        173         CLC
0C02: 71 FC     174         ADC  (SHPBASL),Y ;ADD OFFSET FOR FRAME
0C04: 85 D4     175         STA  FRMBASL    ;TO GET TOTAL OFFSET FOR FRAME
0C06: C8        176         INY
0C07: B1 FC     177         LDA  (SHPBASL),Y ;LOAD OFFSET HI
0C09: 65 FD     178         ADC  SHPBASH    ;ADD HI BYTE OF SHP ADR
0C0B: 85 D5     179         STA  FRMBASH    ;STORE HI BYTE OF OFFSET TO FRAME
0C0D: 18        180         CLC
0C0E: A5 D4     181         LDA  FRMBASL    ;LOAD LO YTE OF OFFSET TO FRAME
0C10: 65 FC     182         ADC  SHPBASL    ;ADD LO BYTE OF PTR TO SHP
0C12: 85 D4     183         STA  FRMBASL    ;STORE LO BYTE OF FRAME PTR
0C14: A9 00     184         LDA  #$00       ;ADD CARRY
0C16: 65 D5     185         ADC  FRMBASH    ;TO HIGH BYTE
0C18: 85 D5     186         STA  FRMBASH
0C1A: A5 08     187 DRAWSHP LDA  YLOC
0C1C: 8D 03 0B  188         STA  DTEMPY     ;SAVE STARTING Y FOR FUTURE REF
0C1F: 6D 00 0B  189         ADC  HEIGHT     ;COMPUTE BOTTOM LINE
0C22: 8D 04 0B  190         STA  BOTTOMY    ;THAT SHAPE WILL USE
0C25: A2 00     191         LDX  #$00
0C27: AD 01 0B  192 DLOOP1  LDA  WIDTH      ;START OF TRANSFER LOOP
0C2A: 8D 02 0B  193         STA  DTEMPX     ;LOOP COUNTER FOR ONE ROW
```


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```
0C2D: AC 03 0B  194             LDY  DTEMPY
0C30: B1 EC     195             LDA  (YTABL),Y  ;GET LO PART OF ADRS
0C32: 18        196             CLC             ;  OF LEFTMOST BYTE OF ROW
0C33: 6D FE 0A  197             ADC  XBYTE
0C36: 85 1E     198             STA  HGADRLO
0C38: A9 00     199             LDA  #$00
0C3A: 71 EE     200             ADC  (YTABH),Y  ;DO SAME FOR HI BYTE
0C3C: 05 E6     201             ORA  HGRPG      ;GET CORRECT HGRPG
0C3E: 85 1F     202             STA  HGADRHI    ;STORE COMPUTED HI BYTE OF ADRS
0C40: A0 00     203             LDY  #$00
0C42: A1 D4     204 DLOOP2      LDA  (FRMBASL,X) ;LOAD NEXT BYTE OF SHAPE
0C44: 51 1E     205 DEORLOC     EOR  (HGADRLO),Y ;EOR WITH WHAT'S ON SCREEN
0C46: 91 1E     206             STA  (HGADRLO),Y ;STORE RESULT BACK ON SCREEN
0C48: 18        207             CLC
0C49: E6 1E     208             INC  HGADRLO    ;INC PTR TO NEXT
0C4B: D0 02     209             BNE  DNOCAR     ;SCREEN ADDRESS
0C4D: E6 1F     210             INC  HGADRHI
0C4F: 18        211 DNOCAR      CLC
0C50: E6 D4     212             INC  FRMBASL    ;INC PTR TO NEXT
0C52: D0 02     213             BNE  DNOCAR2    ;  BYTE OF SHAPE
0C54: E6 D5     214             INC  FRMBASH
0C56: CE 02 0B  215 DNOCAR2     DEC  DTEMPX     ;DEC BYTE COUNTER
0C59: D0 E7     217             BNE  DLOOP2     ;IF ROW NOT DONE, LOOP BACK
0C5B: EE 03 0B  218             INC  DTEMPY     ;ELSE INC ROW COUNTER
0C5E: AD 03 0B  219             LDA  DTEMPY
0C61: 18        220             CLC             ;CHECK IF LAST ROW
0C62: CD 04 0B  221             CMP  BOTTOMY    ;HAS BEEN REACHED.
0C65: 30 C0     222             BMI  DLOOP1     ;IF NOT, LOOP BACK FOR MORE
0C67: 60        223             RTS             ;ELSE ALL DONE!!!
0C68: 60        224 DRAWPART    RTS             ;RETURN IF SHAPE IS PARTLY OFFSCRE
EN

--End assembly--

363 bytes

Errors: 0

Symbol table - alphabetical order:

   BOTTOMY =$0B04      CONT0   =$0B68      CONT1   =$0B70      CONT1B  =$0B7E
   CONT2   =$0B87      CONT3   =$0B99      CONT4   =$0BA3      CONT5   =$0BB2
   CONT6   =$0BBF      CONT7   =$0BCB      DEORLOC =$0C44      DEORLOC2=$0D8F
   DLOOP1  =$0C27      DLOOP2  =$0C42      DNOCAR  =$0C4F      DNOCAR2 =$0C56
?  DRAW    =$0B0C      DRAWPART=$0C68   ?  DRAWSHP =$0C1A      DSTART  =$0B32
   DTEMPX  =$0B02      DTEMPY  =$0B03      FRMBASH =$D5        FRMBASL =$D4
   HEIGHT  =$0B00      HGADRHI =$1F        HGADRLO =$1E        HGRPG   =$E6
   LT256A3 =$0BD9      LT256A5 =$0BF8      SHPBASH =$FD        SHPBASL =$FC
   SHPNO   =$09        SHPTABL =$FA        STOREREG=$0B05      TEMPPTR2=$D2
   WIDTH   =$0B01      WNDWBOT =$0A6B      WNDWLHI =$0A6F      WNDWLLO =$0A6E
   WNDWRHI =$0A6D      WNDWRLO =$0A6C      WNDWTOP =$0A6A      XBYTE   =$0AFE
   XDIV2   =$0AFF      XDIVTBL =$4C     ?  XDRAW   =$0B1F      XLOCHI  =$07
   XLOCLO  =$06        XMODTBL =$D0        YLOC    =$08        YTABH   =$EE
   YTABL   =$EC

Symbol table - numerical order:

   XLOCLO  =$06        XLOCHI  =$07        YLOC    =$08        SHPNO   =$09
   HGADRLO =$1E        HGADRHI =$1F        XDIVTBL =$4C        XMODTBL =$D0
   TEMPPTR2=$D2        FRMBASL =$D4        FRMBASH =$D5        HGRPG   =$E6
   YTABL   =$EC        YTABH   =$EE        SHPTABL =$FA        SHPBASL =$FC
   SHPBASH =$FD        WNDWTOP =$0A6A      WNDWBOT =$0A6B      WNDWRLO =$0A6C
   WNDWRHI =$0A6D      WNDWLLO =$0A6E      WNDWLHI =$0A6F      XBYTE   =$0AFE
   XDIV2   =$0AFF      HEIGHT  =$0B00      WIDTH   =$0B01      DTEMPX  =$0B02
   DTEMPY  =$0B03      BOTTOMY =$0B04      STOREREG=$0B05   ?  DRAW    =$0B0C
?  XDRAW   =$0B1F      DSTART  =$0B32      CONT0   =$0B68      CONT1   =$0B70
   CONT1B  =$0B7E      CONT2   =$0B87      CONT3   =$0B99      CONT4   =$0BA3
   CONT5   =$0BB2      CONT6   =$0BBF      CONT7   =$0BCB      LT256A3 =$0BD9
   LT256A5 =$0BF8   ?  DRAWSHP =$0C1A      DLOOP1  =$0C27      DLOOP2  =$0C42
   DEORLOC =$0C44      DNOCAR  =$0C4F      DNOCAR2 =$0C56      DRAWPART=$0C68
   DEORLOC2=$0D8F
```

X registers will cause the shape to be drawn at the location (-2, -2).

Lines 92-142 check all the possibilities. If either X or Y is negative, if X is less than the left window edge or X+WIDTH is greater than the right window edge, or if Y is less than the window top or Y+HEIGHT is greater than the window bottom, we'll jump to the routine to draw a partially visible shape. If we arrive at line 143, the shape must be completely visible.

Lines 143-170 calculate the frame number that should be used. This is accomplished using the XMODTBL, but is complicated by the fact that the XMODTBL spans two pages of memory. Sometimes it's necessary to access values in that second page, but we don't want to modify the pointer to the XMODTBL. Solution: copy the pointer to another location and increment it there if necessary.

Once the frame number has been computed, lines 171-186 finish computing the pointer to the actual frame data to be used.

So far we've done nothing but set-up work for the main loop! The remaining 30 or so lines actually do the work. For each row, the x counter is initialized to the width of the shape and the address of the first screen byte to be affected is computed. For each byte within the row, a byte of shape data is read, the appropriate action (EOR or NOP)

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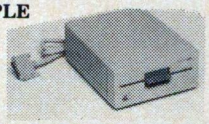

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Circle 49 on Reader Service Card

Listing 2

```
]ASM
                        6    *
                        7    *
                        8            ORG   $6000
                        9    INIT    EQU   $803
                       10    XDRAW   EQU   $B1F
                       11    HGR     EQU   $865
                       12    SHPTABL EQU   $FA
                       13    SHPNO   EQU   $09
                       14    XPOS    DS    1
                       15    YPOS    DS    1
6002: A9 1B            16    DEMO6   LDA   #$1B      ;LOAD A WITH YTABLE ADR HI
6004: A2 00            17            LDX   #$00      ;LOAD X WITH YTABLE ADR LO
6006: 20 03 08         18            JSR   INIT      ;SET UP LOOKUP TABLE PTRS
6009: A9 00            19            LDA   #$00      ;LOAD PTR TO SHAPE TABLE AT $8800
600B: 85 FA            20            STA   SHPTABL
600D: A9 88            21            LDA   #$88
600F: 85 FB            22            STA   SHPTABL+1
6011: 20 65 08         23            JSR   HGR       ;ENABLE HI-RES GRAPHICS PAGE #1
6014: A9 01            24            LDA   #$01      ;WE'LL USE SHAPE #1 OF TABLE
6016: 85 09            25            STA   SHPNO
6018: A9 40            26            LDA   #$40      ;Y-COORDINATE WILL BE 64
601A: 8D 01 60         27            STA   YPOS
601D: A9 00            28            LDA   #$00      ;X-COORDINATE STARTS AT 0
601F: 8D 00 60         29            STA   XPOS
6022: AE 00 60         30    LOOP    LDX   XPOS      ;LOAD UP REGISTERS TO
6025: A9 00            31            LDA   #$00      ;   DRAW SHAPE AT CURRENT X,Y
6027: AC 01 60         32            LDY   YPOS
602A: 20 1F 0B         33            JSR   XDRAW     ;XDRAW THE SHAPE
602D: A2 10            34            LDX   #$10      ;SLOW DOWN THE ANIMATION
602F: 20 46 60         35            JSR   DELAY
6032: AE 00 60         36            LDX   XPOS      ;XDRAW THE SHAPE A SECOND
6035: A9 00            37            LDA   #$00      ;   TIME TO ERASE IT
6037: AC 01 60         38            LDY   YPOS
603A: 20 1F 0B         39            JSR   XDRAW
603D: EE 00 60         40            INC   XPOS      ;XPOS = XPOS + 2
6040: EE 00 60         41            INC   XPOS
6043: D0 DD            42            BNE   LOOP      ;LOOP TILL X = 256 (0)
6045: 60               43            RTS
6046: A0 FF            44    DELAY   LDY   #255
6048: 88               45    DELAY2  DEY
6049: D0 FD            46            BNE   DELAY2
604B: CA               47            DEX
604C: D0 F8            48            BNE   DELAY
604E: 60               49            RTS

--End assembly--

79 bytes

Errors: 0

Symbol table - alphabetical order:

DELAY   =$6046    DELAY2  =$6048  ?  DEMO6   =$6002    HGR     =$0865
INIT    =$0803    LOOP    =$6022     SHPNO   =$09      SHPTABL =$FA
XDRAW   =$0B1F    XPOS    =$6000     YPOS    =$6001

Symbol table - numerical order:

SHPNO   =$09      SHPTABL =$FA       INIT    =$0803    HGR     =$0865
XDRAW   =$0B1F    XPOS    =$6000     YPOS    =$6001  ?  DEMO6   =$6002
LOOP    =$6022    DELAY   =$6046     DELAY2  =$6048
```

is taken, the result stored back in hi-res memory, and the pointers and counters updated.

Well that's it! It's more important that you understand the general algorithm and the shape table structure than every line of assembly code in Listing 1. If you understand the basic algorithm and some of the considerations, you can write similar routines on other computers and in other languages.

Demo Time

Listing 2 is a short demo program that can be used as your stepping-stone to animation greatness! First of all, BLOAD all the machine-language routines presented in Parts 1-4. Then BLOAD a valid shape table at the address $8800. You can use the simple shape table from Part 5 or use one of your own.

If you now BRUN the program in Listing 2, you will see shape #1 of the table scrolled from left to right across the screen. You can alter the delay loop to speed up or slow down the animation. You will probably see some "tearing" of the shape as it moves across the screen. This is caused when the phosphors of the monitor are updated (refreshed) by the electron gun at a time when the shape has been erased. We'll talk about a way to overcome this problem in a future installment.

Next time we'll develop that routine to handle shapes that are only partially visible. Experiment with different shapes, and vary Y instead of (or in addition to) X in the demo program. Toodles!

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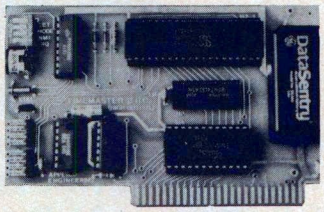

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BRAND C	NO	NO	NO	NO	NO	NO	NO	NO
BRAND M	NO	NO	NO	NO	NO	NO	NO	NO
BRANDP	YES	YES	NO	YES	NO	NO	NO	NO
BRAND S	NO	NO	NO	YES	NO	NO	NO	NO
BRAND T	YES	NO	NO	NO	NO	NO	YES	NO

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VISION 80	MORE	YES	NO	NO	YES	NO	NO	NO
OMNIVISION	MORE	NO	NO	NO	NO	NO	YES	YES
VIEWMAX 80	MORE	YES	NO	NO	YES	NO	NO	YES
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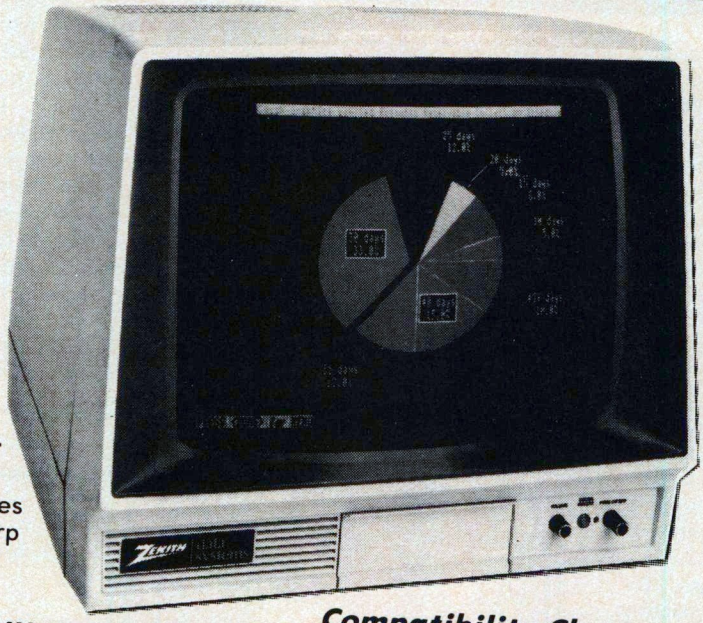

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Commodore 128	RGB/Composite
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Making (Sound) Waves with Macintosh

William K. Dolen

FOR me, one of the more interesting and practical aspects of mathematics is Fourier's theorem, which states that any complex periodic waveform can be represented as a sum of sine waves of various frequencies and amplitudes. Since musical sounds at steady state are complex periodic waveforms, it turns out that the sound of a clarinet can be expressed in a mathematic notation different from that of a trumpet. This one aspect of the many relationships between music and mathematics was exploited in early electronic organs, notably the Hammond, and is a feature of most music synthesizers. The Apple II speaker can be "toggled" to produce square wave musical tones, but an add-on peripheral is necessary for the production of other complex waveforms.

Although the built-in Macintosh synthesizers do not directly have the capability for Fourier synthesis, they will attempt to reproduce any waveform given them, including human speech. The purpose of this article is to present a utility program, written in Microsoft BASIC 2.0, which will create complex waveforms, to your specifications, in a format suitable for presentation to the Mac synthesizers.

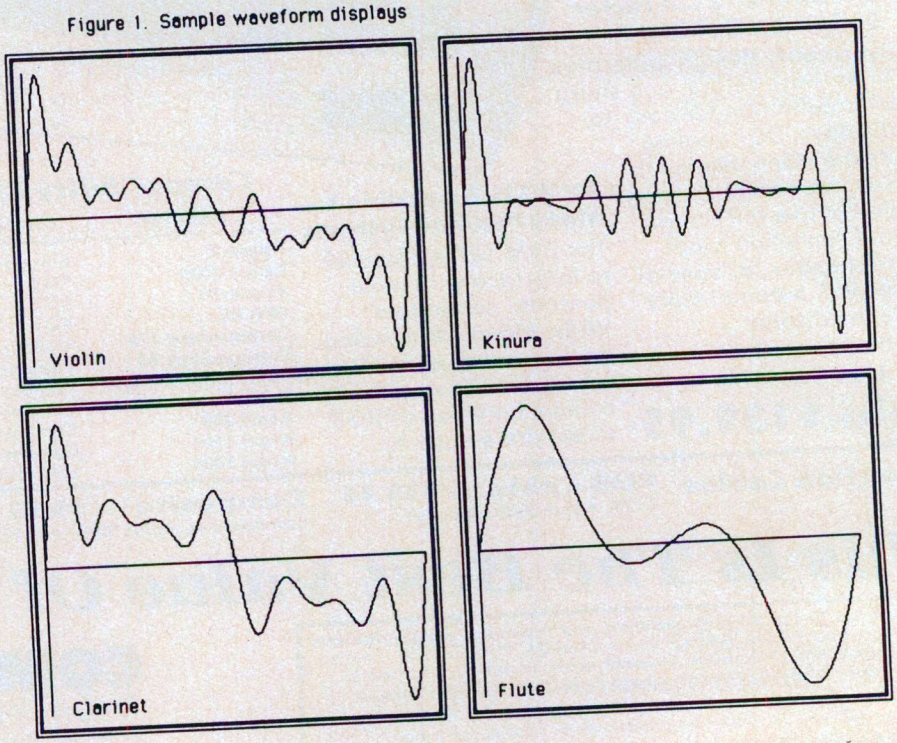
Fourier Analysis

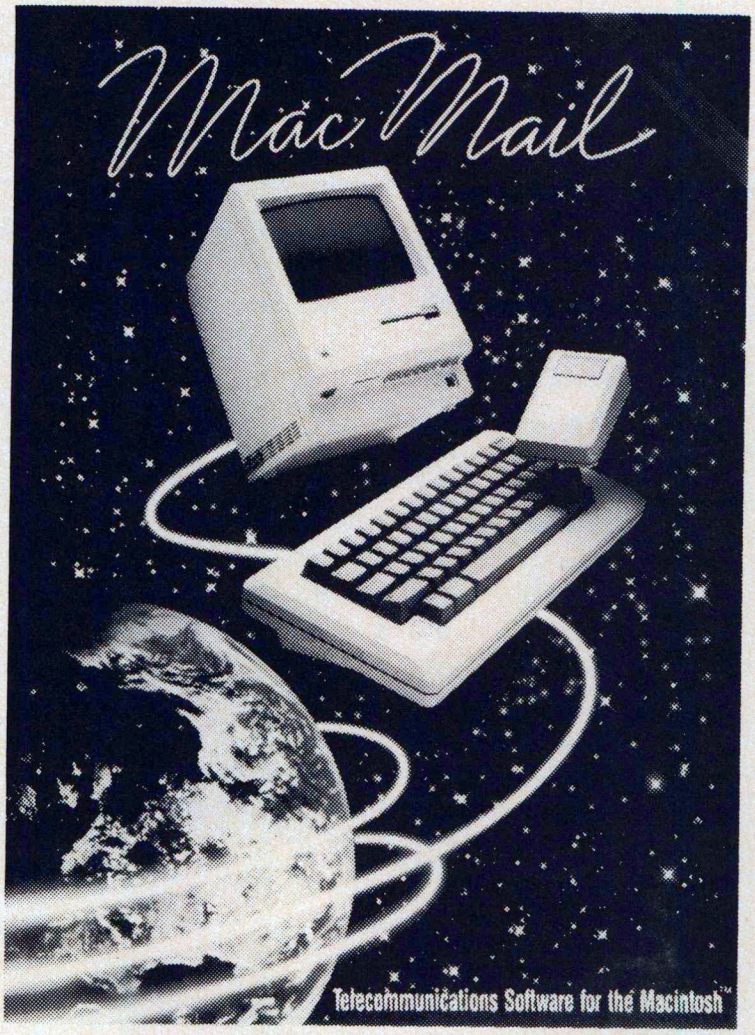
Let's start with some definitions and explanations. Fourier analysis is a method by which a complex waveform is broken down and expressed as the sum of sine waves of various frequencies and amplitudes. One of my college math professors assured me that it can be done manually, but it is apparently a tedious process. It is also possible to let a computer do the dirty work, but for musical applications, the most practical way I've seen it done is with a gadget called a spectrum analyzer. This piece of hardware has a microphone, plus the right kind of electronic circuitry (filters and the like), to analyze the waveform and display its components on an oscilloscope. Fourier synthesis is the reverse process, by which a complex waveform is created (or recreated) by adding together various simple waveforms. This is what a Hammond organ does with its harmonic drawbars.

The Harmonic Series

Now for some physics. Middle A on the piano is a pitch which can be represented by a simple sine wave, called the fundamental or first harmonic, repeating itself 440 times a second. The second harmonic, unfortunately also called the first overtone, is a sine wave sounding an octave higher. The third harmonic sounds a perfect fifth above the second harmonic. The successive, even numbered harmonics are octave transpositions of the fundamental, but most of the odd numbered harmonics represent pitches which have no exact keyboard equivalent. Complex waveforms created by the synthesis program (Figure 1) may contain as

Figure 1. Sample waveform displays





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many as twelve harmonics (the fundamental and the first eleven overtones). The program can be modified if you want more, but the Mac does not reproduce extremely high frequencies very well.

Varieties of Timbre

Consider the oboe and the French horn. These instruments look different, sound different, and have different Fourier spectra. Their spectra have been analyzed and can be found in any good acoustics text. If the appropriate relative amplitude values for each harmonic are input into the synthesis program, the result will resemble the sound of an oboe or French horn. Don't go taking your Mac to orchestra rehearsal, however. The initial sound of an instrumental note, called the attack, is a series of very rapidly changing waveforms, called transients, which finally settle down into the steady state waveform. As luck would have it, these transients (which are very hard to analyze) largely define a person's mental image of what a given instrument sounds like. Just to make things downright complicated, it happens that the steady state spectrum components change not only from note to note, but also from one instrument to another. In other words, middle A on my French horn will have a different spectrum from middle A on your French horn, even if I play both instruments for the spectrum analyzer. Another factor important in sound perception is the use of vibrato, a distinctive feature of the stringed instruments difficult to reproduce in the Macintosh system. Nonetheless, by using the waveform synthesis program, you will be able to produce a variety of distinctly different instrumental sounds.

Using the Program

The program builds a complex waveform by adding sine waves of different amplitude and frequency. The function which does this is as follows:

$$f(x) = \sum_{i=1}^{12} A_i \sin(ix)$$

The program is set up so that one cycle of the fundamental harmonic spans a range of X values from 1 to 256, the size of the array needed by BASIC. The number (1-12) of each harmonic is represented by "i," and A_i is its amplitude. The program calls the SIN function as many as 3072 times, accounting for its relative slowness. The resulting numbers are scaled to the range -128 to 127, values which the Mac expects to find when playing a note. As the new waveform is displayed, the program plays a short demo tune taken from one of the Mozart dice games.

When using the program, you'll want to experiment with a few unnatural harmonic combinations, but the time will come when you need a reedy clarinet sound for a Mozart piece. Recipes for this and other sounds will be found in Table 1, and a few of them are graphed in Figure 1, produced by BASIC with MacPaint enhancements. Another extensive source of amplitude values is a Hammond organ stop dictionary. The Hammond drawbars specify amplitude on a scale of 0 to 8 for as many as 12 harmonics; the older models only provide for 8 harmonics. A typical registration, producing a string-like tone, can be written as follows:

00 4426 242 11

The two digits on the left represent pit-

Table 1. Possible Amplitude Values For Various Instrumental Sounds

Harmonic	1	2	3	4	5	6	7	8	9	10	11	12
Flute	7	7	1	0	0	0	0	0	0	0	0	0
Oboe	9	10	2	1	3	1	0	0	0.5	0	0	0
Clarinet	10	2.5	5	1.1	5.8	2	5	2	1	0.2	0	0
Violin	10	6	6	6.8	4.7	2	4.7	1.2	4.7	2.7	3.3	3.3
Trumpet	10	10	8	7.5	4	3	1	1	0.4	0.4	0	0
Tuba	9.5	10	5	1	0	0	0	0	0	0	0	0
Organ 1	9.5	0	8	0	7.2	0	5	0	4	0	0	0
Organ 2	3	6	4	5	1	2	2	4	1	2.0	0	1
Organ 3	5	8	4	7	2	1	4	4	2	2.0	0	1
Kinura	0	1	2	3	4	5	7	6	3.5	8.0	0	4
Krummhorn	1	1	3	4	5	1	1	1	0.5	1.0	0	0.5

```
REM Waveform synthesis for Macintosh music
REM Microsoft BASIC version 2.0
REM William K. Dolen

DIM WaveArray% (256)

WINDOW CLOSE WINDOW(0)
WINDOW 2,,(310,30)-(502,260),2
PRINT "HARMONIC", "AMPLITUDE"
WINDOW 1,,(60,120)-(180,150),2

Pi= 3.1416
max= 0

FOR i = 1 TO 12
  CLS
  PRINT "Harmonic";i
  INPUT "Amplitude:", ampl: CLS
  PRINT "CALCULATING";
  WINDOW 2: PRINT i,ampl: WINDOW 1
  IF ampl = 0 THEN GOTO Bypass
  ampl= ampl * 50
  Const= i * 2 * Pi: REM relative frequency for this harmonic
  FOR j= 1 TO 256
    REM one cycle (2π) of the first harmonic ranges from 1 to 256
    WaveArray%(j)= WaveArray%(j) + SIN (Const * j / 256) * ampl
    IF WaveArray%(j) > max THEN max= WaveArray%(j)
  NEXT j
Bypass:
NEXT i

REM scale to range of - 127 to 127
FOR i = 1 TO 256
  WaveArray%(i)= (WaveArray%(i) / max) * 127
NEXT i
```

```
REM Graph of complex waveform

REM Scaling
YS= 200/255
XS = 1
DEF FNXSCALE(X)=INT(XS*X)+10
DEF FNYSCALE(Y)=200-(INT(YS*Y))+15

WINDOW CLOSE 1
WINDOW 3,,(10,30)-(290,260),2
CALL SHOWPEN

REM  Draw the coordinate axis

LINE (10,15)-(10,215): REM y axis
LINE (10,115)-(266,115): REM  x axis

REM Plot the curve
px%=FNXSCALE(0): py%=FNYSCALE(127)
FOR i = 1 TO 256
  y= WaveArray%(i) + 127
  px1%=FNXSCALE(i):py1%=FNYSCALE(y)
  LINE(px%,py%)-(px1%,py1%)
  px%=px1%: py%=py1%
NEXT i

REM Omit the remainder of the program if you do not want a music demo.

REM MUSIC DEMO. Synthesizer #3 is not used.
REM Sound quality is better with an external speaker.
REM Program is stopped from the menu bar.

  WAVE 0, WaveArray%
  WAVE 1, WaveArray%
  WAVE 2, WaveArray%
  WAVE 3, SIN

tempo!=180: tempo!= 8 *18.2 /(tempo! / 60)

loop1:
SOUND WAIT
loop2:
READ freq,dur!,voice
dur!=tempo!/dur!
IF freq = 999 THEN SOUND RESUME: GOTO loop2
IF freq=9999 THEN RESTORE: GOTO loop1
SOUND freq,dur!,,voice
GOTO loop2

REM Measure numbers
'1
DATA 0523,16,0,0000,16,0,0523,08,0,0659,16,0,0000,16,0,0659,08,0
DATA 0329,08,1,0392,08,1,0329,08,1,0392,08,1
DATA 0131,08,2,0000,08,02,0131,04,2
'2
DATA 0784,16,0,0000,16,0,0784,08,0,0659,08,0,0523,08,0
DATA 0329,08,1,0392,08,1,0329,08,1,0392,08,1
DATA 0131,04,2,0000,04,2,0999,99,9
'3
DATA 0587,16,0,0000,16,0,0587,16,0,0494,16,0,0392,08,0,0440,16,0,0494,16,0
DATA 0247,08,1,0293,8,1,0247,08,1,0293,08,1
DATA 0196,04,2,0098,04,2
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ches lower than the fundamental, and are to be ignored for our purposes. The third digit from the left specifies the relative amplitude for the fundamental. The fourth digit is the value for the second harmonic, the fifth digit is for the third harmonic, and so on up to the eighth digit, which is the sixth harmonic. The ninth digit of the Hammond stop represents the relative amplitude of the eighth harmonic. The tenth digit is the amplitude of the seventh harmonic, and half of that value is used for the amplitude of the ninth harmonic. Finally, the eleventh digit is the amplitude of the tenth harmonic; again half is used for the twelfth harmonic. Thus, the equivalent amplitude values for entry into this program would be:

Hammond registration:	**00 4426 242 11**
Harmonic	**1 2 3 4 5 6 7 8 9 10 11 12**
Amplitude	**4 4 2 6 2 4 1 2 0.5 1 0 0.5**

The Hammond system does not use the eleventh harmonic, and the older instruments do not have drawbars for harmonics 7, 9, 10 and 12.

If you like creating waveforms for the Mac synthesizers, you will eventually want to modify the program to save some of the better ones to disk. The music demo section of the program is a framework around which a full fledged music program can be built, or you can adapt existing public domain BASIC programs to read in saved waveforms, providing different instruments for each of the four synthesizers. Have fun!

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'4
DATA 0523,16,0,0494,16,0,0523,16,0,0587,16,0,0523,16,0,0000,16,0,0523,08,0
DATA 0329,16,1,0000,16,1,0329,16,1,0000,16,1,0329,16,1,0000,16,1,0329,08,1
DATA 0131,08,2,0000,08,2,0131,04,2,0999,99,9
'5
DATA 0293,8,0,0370,16,0,0440,16,0,0587,16,0,0740,16,0,0880,16,0,0740,16,0
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DATA 0147,08,2,0000,08,2,0147,04,2
'6
DATA 0784,16,0,0740,16,0,0659,16,0,0587,16,0,0523,16,0,0494,16,0
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DATA 0293,04,1,0000,04,1
DATA 0124,04,2,0000,04,2,0999,99,9
'7
DATA 0659,16,0,0523,16,0,0659,16,0,0523,16,0,0440,08,0,0740,08,0
DATA 0329,16,1,0000,16,1,0329,08,1,0293,16,1,0000,16,1,0293,08,1
DATA 0131,04,2,0147,04,2
'8
DATA 0784,04,0,0000,04,0
DATA 0494,04,1,0000,04,1
DATA 0098,04,2,0196,04,2,0999,99,9
'9
DATA 0880,16,0,0988,16,0,0880,16,0,0784,32,0,0000,32,0,0784,16,0,0740,16,0
DATA 0659,16,0,0587,16,0
DATA 0220,08,1,0293,08,1,0220,08,1,0293,08,1
DATA 0147,08,2,0000,08,2,0147,04,2
'10
DATA 0784,16,0,0988,16,0,0784,16,0,0587,16,0,0494,16,0
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'11
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DATA 0329,08,1,0000,08,1,0329,04,1
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'12
DATA  0587,08,0,0494,08,0,0392,04,0
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DATA 0098,04,2,0196,16,2,0174,16,2,0165,16,2,0147,16,2,0999,99,9
'13
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'14
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'15
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DATA 0587,16,0,0523,16,0,0494,16,0
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DATA 0098,04,2,0196,04,2
'16
DATA 0523,04,0,0261,02,0
DATA 0329,08,1,0000,08,1,0329,02,1
DATA 0131,08,2,0000,08,2,0131,02,2,0999,99,9

DATA 0000,01,0,0000,01,1,0000,01,2
DATA 9999,99,9
```

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Designed by Joy George

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Hardware design by Bob Brice — Software by Bob Sander-Cederlof

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for APPLE //e & //c

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for APPLE][and][+

With this adapter, owners of early APPLEs can take advantage of the newer 9-pin game products, such as paddles, joysticks, **MUPPET LEARNING KEYS**™, etc. **NOTE** – If you have more than one game I/O device, consider purchasing our **PADDLE-ADAPPLE COMBO** or **PADDLE-ADAPPLE 'D'** instead. **$14.95**

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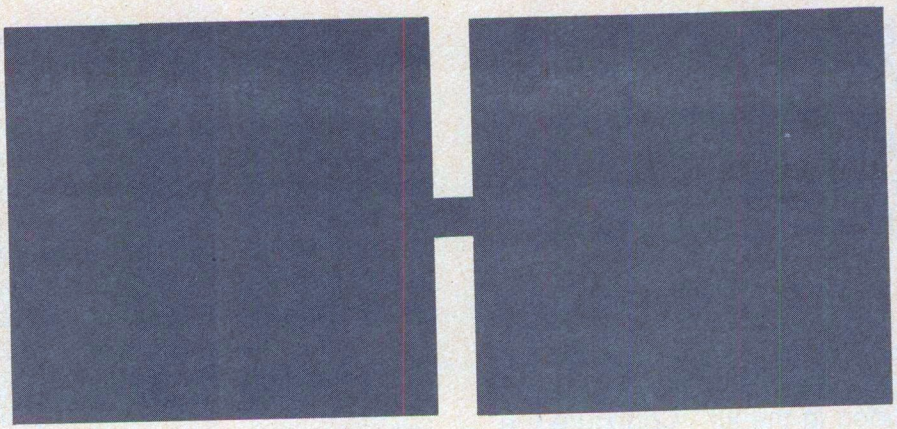
The ABC's of BBS's Part 3: The User



Philip Chien

IN two articles last year (March and April, 1984), I discussed BBS's from the operator's (or SYSOP's) viewpoint. Now I'd like to consider the most important people on the BBS's—the Users.

If you don't already know, BBS stands for Bulletin Board System, and SYSOP stands for SYstem OPerator (the person who runs a BBS). A BBS is an electronic "meeting place" for discussions, items of interest, what's happening, as well as the activities you'd associate with a supermarket swap'n'trade bulletin board.

Why Use a BBS?

Many people ask, "Why should I use my computer and phone to call a person with a message, when I can simply talk to that person with the same phone call?"

I feel a BBS offers many advantages. When you talk to a person, the conversation is usually lost, while a BBS can document all exchanges. On a BBS, a message meant for one person can be responded to by others, as long as the message is public. Private electronic mail offers the advantages of an answering machine (you can't catch somebody sleeping, in the bath, or out), as well as better accuracy (e.g. if you send information about a meeting, it can be directed to a printer, rather than scribbled on a notepad). Written discussions can be dynamic, as opposed to the slower, static monthly responses of club newsletters and magazines.

A BBS is also an excellent way to meet new people. You can get to know a person's "true" personality, intelligence, and attitude without any pre-conceived notions based on looks or voice. The phone line connection also allows a degree of protection and anonymity. You can safely discuss controversial topics while you are just a name or handle on the other person's screen.

What You'll Need

Besides your Apple, you will need either a communication card (included on the Apple ///, //c, Mac, or Lisa), cable and modem, or a modem designed for the Apple with its own built-in serial interface. You will also need a phone line, the phone number of at least one bulletin board, and, of course, a phone. Because of FCC regulations, the phone must *not* be a mobile phone, party line, or pay phone. I highly recommend that the phone line *not* have "call waiting" service. If you are online with another computer, and a phone call comes in, the call waiting click may cause your modem to disconnect. Although not necessary, a "smart" terminal program with download/upload capabilities (e.g. ASCII Express, Data Capture, etc.) is desirable.

If you don't want to connect your modem directly into your phone system, then a communication card, such as Apple's Super Serial card or Videx's PSIO card, and an acoustic coupler is preferred. In order to use most acoustic modems, your phone must have a *standard* handset.

Most people prefer to use a modem with a built-in Apple interface, since better control over the modem is possible, more software is available, and in most cases a com-

bined modem and interface is less expensive. Hayes' Micromodem has been around since 1978. One major improvement since the release of the original modem is the addition of Touch Tone dialing. This modem is adequate for most normal purposes, and, since it has been out for over 5 years, has more software available than all other modems on the market put together. Novation's Apple Cat is a more powerful modem, and is preferred by software hackers, since it's transmitter and receiver can be controlled via software.

In general, the least expensive modems run at 300 baud (bits per second), which is about 30 characters per second. Becoming more common are 1200 baud modems, which cost more initially, but save time (and possibly money) by transferring data 4 times as fast, as long as the BBS is set up for that speed. There are also 2400 baud modems, which may catch on someday.

Should budget constraints be a major factor, a good, inexpensive modem is the Modem II by Multi-tech. It is Micromodem compatible. The Micromodem, Modem II, and Apple Cat all plug into a free Apple slot, and attach directly to the phone line via a standard RJ11 modular jack.

Many software programs require your modem to be in slot 2, and the Pascal and CP/M operating systems will accept the modem as an auxiliary I/O device if the modem firmware follows the proper Pascal protocols. Do not install the modem in slot 3, unless you plan to use it as an external I/O device, since Pascal and CP/M will register the modem firmware as an external terminal.

Phone Links

Before attaching the modem you should tell the phone company the FCC registration number and ringer equivalence number (both numbers are in your modem's manual). These requirements are part of the FCC regulations (Part 68) and are designed to help protect phone company lines from possible damage by faulty equipment. As with any phone you own, the phone company won't charge extra just for using a modem; but they will charge you if you need a service call for installation of another phone jack, if your modem messes up their phone lines, or if you ask them to determine the cause of a problem and they find a problem with your equipment.

Attaching a modem to the phone line properly is usually simple. First you notify the phone company, then you just plug the modular cord from the modem to an extra modular jack. If you don't have a modular jack, then you can either get a Y-adapter which will change an existing jack into two jacks, or install an extra jack. Any local electronics or phone store should be able to assist you in finding the proper parts.

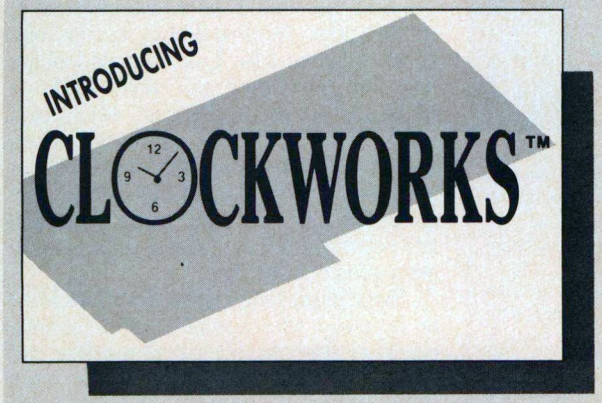
A Human Network

You may have originally obtained your modem in order to use a "Bank at home" service, to get Dow Jones quotes, or to access a large database such as "Delphi" or the Source.

Perhaps you'd also like to communicate with other users. Large databases have massive information files, dozens of online games, news wire reports, and various other services; but the local bulletin boards have many of the same types of information (on a smaller scale) and usually more specialized or localized discussions.

A bulletin board is usually privately funded, and the system operator runs the board for his/her own enjoyment. Since bulletin boards require a lot of time and money to operate—and many starting SYSOPs don't realize just how much—many boards shut down after a short time. Because of this, phone lists of operating bulletin boards listed in magazine articles and other bulletin boards' online lists are usually out of date. Most local, user-oriented computer stores will know the number of a couple of BBS's, and some even run their own boards.

Once you find the number of one board, finding other boards is easier. Most BBS's list numbers of other boards, and most SYSOPs advertise their boards on other boards. You'll want to call various BBS's to see which ones you are comfortable with. In



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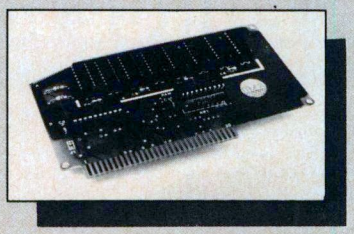

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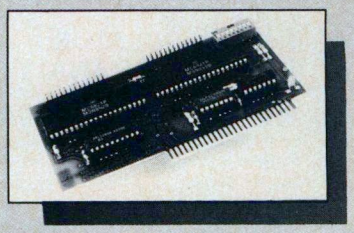

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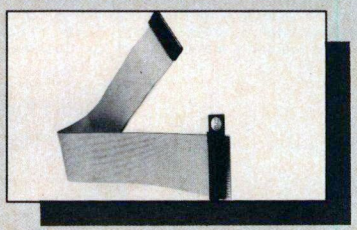

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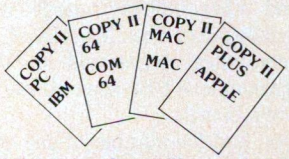

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my area there are boards with specific topics on: Space, Science Fiction (in fact there is a specific board for discussions on the British Televison series "Doctor Who"), Trivia, Jokes, and, of course, computers. There are also boards with limited memberships (e.g. women only, adults only, etc.) and boards run by companies or government organizations for the use of their employees and contractors.

Most local boards have no written guide or manual for first-timers. When you call a local board, you start in a "new user mode" where menus tell you which keystrokes you can type, and what commands will be executed. When more experienced, you can usually set an "expert user mode" where the menus only appear when you ask for them. Most boards also have an information section on how to use the board, which you can read and download. If you still can't figure out how to use a system, most SYSOPs are quite helpful in teaching new users.

BBS's are very addictive. You may find yourself calling boards for several hours each day, and posting or reading messages on dozens of local boards. Unless you have unlimited local phone service, you may find your phone bill doubling or even tripling.

Extending Your Reach

Here's something else to worry about. After you've tried all of your local BBS's, you may hear about an interesting one in another area. This can lead to sizeable long distance phone bills. I recommend looking into long-distance services such as Metrophone, All-net, Sprint, MCI, etc., which, in my experience, give excellent service at 300 baud, and passable service at 1200 baud. At 1200 baud the slightest line noise will cause characters to get garbled, and you may need to re-dial several times to get a good enough line.

Since many long-distance services must be accessed with special touch-tone code numbers after dialing a local number, not every modem can handle this task automatically. Be sure you know how to connect with your system through auto-dialing, or at least manual access.

I recommend avoiding a satellite linkup when dialing a distant computer because the round trip your signal will have to travel takes about two seconds. If you are just reading or writing a file this won't make a difference, but if you are chatting, or typing in responses manually, then the two second delay between the time you type in a character and when you see it echoed can be as annoying as a type-ahead buffer gone crazy.

BBS's originally started out as local meeting places for computer hackers; but they have expanded to become general discussion areas, and a new medium of communication for the 1980's.

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Review: Mouse Calc

Steve Ross

Product: Mouse Calc
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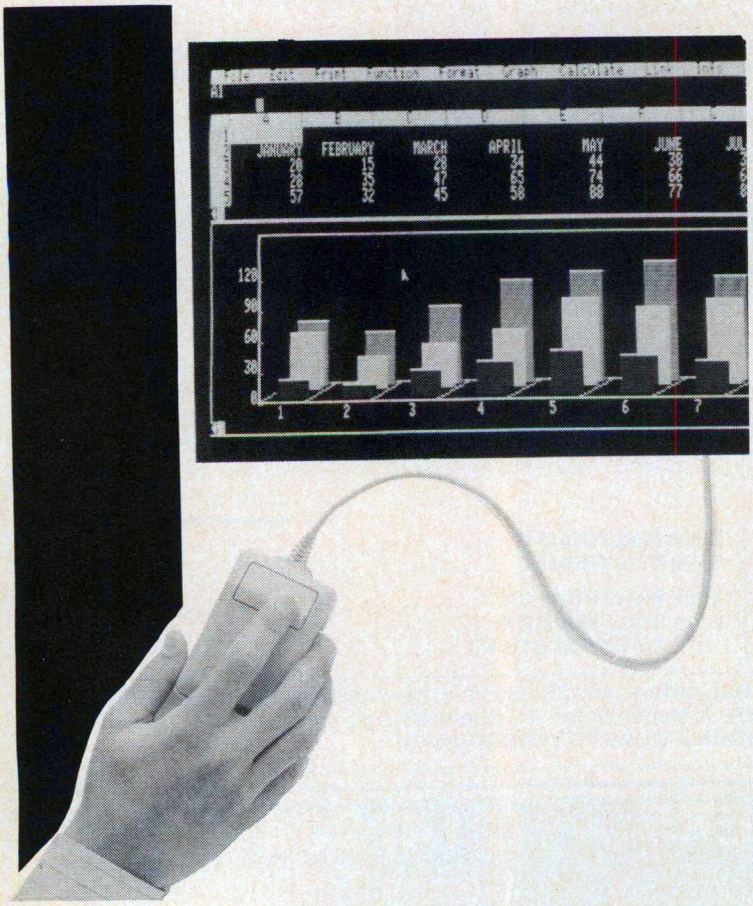

ONE of the first questions that comes to mind when evaluating a new software product, especially something in the "general purpose" category like a spreadsheet, is whether there is room in the marketplace for such a program.

Fortunately, the answer is almost always maybe, and maybe is good enough both to keep developers striving for new excellence, and to make an evaluation useful. As with most tools, the issue of whether a software package is good for you is largely a matter of taste, once it is established that the package performs a fairly standard set of functions. There are trade-offs one has to make in determining what tool is "best"–trade-offs involving speed, versatility, and functionality. Since use of software tools is such a personal pursuit, I often find myself hoping that each new market offering will be the one that is perfectly tailored to me.

General Overview

Mouse Calc is a standard spreadsheet program, much like VisiCalc, the spreadsheet portion of AppleWorks, or THE Spreadsheet. Mouse Calc, however, offers a few new wrinkles that reflect the changing face of the microcomputing environment:

- Mouse Calc is mouse-driven, and relies heavily upon the AppleMouse II as an input device.
- Mouse Calc includes an integrated chart package which, although limited, is useful in understanding and presenting the data being manipulated.

Hardware Requirements

To use Mouse Calc, you must have

- 128K Apple *//e* or and Apple *//c*.
- An AppleMouse II
- At least one floppy disk drive (Disk II, or compatible).
- A video display monitor. Although this is not, strictly speaking, a requirement of Mouse Calc, it is apparent that the double hi-res graphical presentation of text will suffer a great deal in the translation to RF for presentation on a television.

The Package

Mouse Calc comes attractively packaged in a slip-sleeve binder, and consists of the documentation, three disks, and a double hi-res jumper.

The three disks are the Program Disk, the Backup Disk, and a Samples Disk. Unfortunately, the Program Disk and Backup Disk are copy protected. This is a reflection of the developer's quandary of what to do about the users who are prone to "borrowing" software rather than purchasing it. Nonetheless, copy protection limits the range of peripheral devices Mouse Calc can support.

The double hi-res jumper is supplied for those who have an Apple *//e* with an extended 80-column text card, but either never had, or have misplaced,the jumper that enables the double hi-res mode. The jumper is simple to install; and besides installation of the Mouse, it is the only hardware modification required to run the program.

Unique Features

Mouse Calc offers some unique features not found on many other spreadsheet programs for the Apple II. Chief among these features is the mouse support. This allows the user to "point" to the function desired, or "pull down" a menu that contains the correct function. This eliminates most keyboard input once the base data has been entered.

In keeping with the software implementations on the Mac and Lisa, Mouse Calc has vertical and horizontal "scroll-bars," or "elevators," that allow the user to travel quickly from one place in the spreadsheet to another. You still must do some guessing when using the elevators, but they provide a quick way to go places, and back if you overshoot.

The "desktop" is implemented as a compromise between the

completely iconic Mac/Lisa environment and the text-based environment normally associated with the Apple II. Spreadsheet files are marked in the directory with a row-column type of icon, while text files (ostensibly from a word processing program) are marked with a "memo" icon. As with most icon systems, it takes a short time to get used to the look of the particular icons, but they are different enough to tell at a glance what you are about to load.

In addition to the memos and spreadsheet files, there is one other icon of note: the "folder" icon. This should be familiar to most Apple computer users as it is used heavily on the higher-end Apple machines, and is filtering down to the Apple II in such programs as AppleWorks. A folder is really a ProDOS subcatalog, and is a handy way to keep all the files for a particular project isolated from your other work. This is not mere convenience; on a fixed disk such as the Profile or the Sider, where you can store great quantities of data, you have to create these subcatalogs to preserve your sanity. Mouse Calc supports ProDOS path commands in a very convenient manner which will be discussed further below (under implementation).

One of the more compelling features of Mouse Calc is its ability to display data graphically on the screen. This display is extremely fast, and takes place in a window that you set up. That means that you determine the size of the window, and can view both the data and the graph simultaneously. If you change the data, the chart is updated when you select the "Calculate Now!" menu item. An interesting aspect of the way Mouse Calc presents the graphics is that the chart can be scrolled left and right using the horizontal scroll bars if it is too large for the window provided.

The graphics are rather limited. Given the lack of provisions for data or axis labeling, tilting and color/texture selection, I would say that they are not suitable for any but the most rudimentary presentations.

Mouse Calc can do three kinds of charts: clustered bar charts, 3-D clustered bar charts (often called "city block" charts), and connected line graphs.

Implementation

Mouse Calc is implemented as a mouse-driven program, and comes with most of the "gadgets" normally associated with the mouse. For better or for worse, these "gadgets," such as the floating arrow pointer, scroll bars, and elevators, tend to imply a graphics display. If you have done much work on the Apple II, you have probably learned that to update a graphics screen takes a great deal more time than a text screen. This makes scrolling a bit time-consuming. As most mouse advocates will be quick to point out, what you get in return for the slightly slower screen handling is a far friendlier user interface.

Display Management

The display is implemented as a series of character graphics, one of which is the arrow or mouse. These characters are painted on the screen at the standard character positions, emulating the standard 80-column text display. For that reason, the arrow does not move as smoothly as one might expect when the mouse is moved. It does, however, guarantee that the arrow is on a valid "hot spot" when the mouse button is clicked. If you are used to the Mac or the Lisa, this is a bit strange, because the arrow completely covers up the character to which it is pointing.

Mouse Calc looks so much like Apple's 68000 machines at first that I was surprised when an inconsistency appeared. On the Mac and Lisa, the software developers have been careful to implement editing of text (in this case numbers, text, and formulae) with the mouse. I expected the familiar "I-Beam" text editing cursor to show up when I tried to edit a cell. This is not the case—all editing of cell

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contents must be done by selecting the pull-down menu option "Edit a Cell." Selection of this option gives you access to the contents of the highlighted cell, and horizontal movement within the line is performed with the arrow keys. The mouse is effectively dead during this process.

The elevators for quick horizontal and vertical movement are a clever feature, and provide a good way of moving long distances within a worksheet. However, the elevators are not different enough in appearance from the cursor—in fact they look exactly the same as the cursor, the "window bar," and an inverse space. This is clearly not the case on the Mac or Lisa, and MousePaint shows us the Apple //e can certainly perform this differentiation even without double hires. Another problem applies not only to Mouse Calc, but also to the "calc" programs on the Lisa and Mac. The elevators are adjusted such that when pulled all the way to the right, they position the cursor at the rightmost cell in which data may be entered (in this case BK), and when pulled all the way down, they position the cursor at the lowest cell in which data may be entered. This is normally inapplicable to the worksheet in memory—better (in my opinion) to calibrate the elevators relative to the actual size of the worksheet currently in memory so you don't wind up 100 rows too far down.

It would be less than truthful for me to say the display speed was fast. In fact, I would say that the major weaknesses of the program revolve around display management. The average screen repaint time was just over two seconds. This is fairly slow in comparison to text mode spreadsheet programs, but if you add to that the fact that Mouse Calc repaints the screen every time you scroll one row or column, you can imagine how long it takes to get very far using the mouse! The argument is that the elevators were provided for that reason, but I failed to see any way to mark large blocks of cells other than holding down the mouse button and waiting. A speed-up card would improve this aspect of Mouse Calc dramatically.

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User Interface—General Menus

The pull-down menus function almost exactly like those on the Mac or Lisa—there is a horizontal bar across the top of the screen with the titles of the menu items. All you have to do is press the mouse button while the pointer arrow is on one of the menu items and drag the mouse down to use the menu. An inverse bar moves up and down in the menu, following vertical mouse movement, until the button is released. The release of the button is considered a selection. This presents an initial problem if you happen to let go at the wrong time, but with a few minutes of practice, you get used to this method of selection.

The advantage of the mouse/graphics menu interface is its consistency. All selection is performed in a predictable and consistent manner. You are never left guessing, as in many text-based applications, whether to just press the key corresponding to a menu choice, press the key and then the RETURN button, use the arrow keys, or any number of other selection processes.

I felt that there should have been alternative key commands either for activation of the menus, or for the commands themselves. Some users will simply not always want to use the mouse.

File System Interface

The interface to the ProDOS operating system is probably one of the most carefully thought out parts of Mouse Calc. File load and catalog work in much the same manner. Once you ask for the operation, a window opens up with a list of files. Some of these files are folders (subdirectories). Access to the folders is simple in Mouse Calc.

While AppleWorks insists you enter the entire path name (from scratch) to change directories, Mouse Calc simply presents you with a list of names and associated icons. If you click on a folder icon, you will be transferred down one directory level. Slightly less clear is the fact that if you click in the empty space above the list, you will traverse up one directory level.

Rather than worrying about where your folder is going, you may safely assume that Mouse Calc is placing any new folder you create using the Create Subdirectory command inside of the current folder (if any).

If you are at the top (or root) of a directory tree, and you click in the empty space at the top of the list, Mouse Calc will search all the volumes online at that time, and present a list from which you may choose. This is a handy way to change volumes "on the fly".

Entering Formulae With a Mouse?

Mouse Calc has a pull-down menu item called Functions that allows you to enter most formulae simply by pulling down the menu repeatedly and pointing to the appropriate operators or functions. This is not a menu item I would use often, but it is novel.

Functions

The library of functions available in Mouse Calc is reasonably standard, but at the same time rather disappointing. There are no trigonometric functions, no financial functions, and no date/time functions. The omission of all of these would seem to relegate Mouse Calc to the home/hobby market where there is less demand for these kinds of calculations.

Precision

The numerical precision maintained by Mouse Calc is reasonably standard in the Apple II market—twelve digits. Further precision is ignored, but the exponent is maintained appropriately. One limit that should be mentioned here is that of the magnitude of numbers that may be entered: I was only able to enter numbers in the range 10 E+99 through 10 E-99 (although there were times when values of over E70 failed). The message you get from Mouse Calc is much the same as with other spreadsheet programs, the ubiquitous "ERROR." Clearly this is a domain problem, and the user would be provided with more clues if it were reported as such. The precision maintained in Mouse Calc should be sufficient for most needs.

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Number Formatting

Mouse Calc presents a formatting menu that is significantly better than those found in many other spreadsheet programs for the Apple II. It includes currency format and comma format, which are notably lacking in several other entries in the spreadsheet race. This enables the user to create a more "professional" looking report. It also makes larger numbers more readable, and reports combining dollars and other units more clear.

Memory Size

Mouse Calc is a fairly large program, although it is partially disk resident, and does not leave a huge amount of memory for the actual data; but it does leave enough to construct some fairly hefty worksheets. The lack of support for alternative memory devices such as large RAM cards and disk does limit the expandability of Mouse Calc.

"Integratability"

Moving data from Mouse Calc to other programs presents the same problem as with most spreadsheet programs, you must use the DIF file data transfer mechanism. This problem is somewhat relieved by the fact that there is a chart package resident in Mouse Calc.

You may also print your worksheet to disk for inclusion in a word processing document. This straightforward approach makes a great deal of sense, and for some reason is almost totally ignored by the user community.

Special Features

Aside from the mouse interface, Mouse Calc conforms fairly strictly to the established rules for building a VisiClone. There is, however, one feature particularly worthy of note: iterative calculation. I will not go into this in great depth, but the general concept is to build a worksheet that will not converge upon a correct recalculation in one try, but rather approaches a limit (set by the user) as successive recalculations occur. This iterative technique takes a great deal of ingenuity to use, but can be extremely handy in such matrix-related problems as the resolution of a system of simultaneous equations, or a simplex optimization model. Such problems tend to be extremely burdensome on the CPU even in specialized systems, so I don't recommend that you purchase Mouse Calc to solve linear programming problems, but the iterative approach may come in handy some time when you aren't expecting it.

Documentation

The documentation that comes with Mouse Calc is divided into two sections: the tutorial, and the reference section. The tutorial is reasonably comprehensive, and certainly does not presume too much knowledge. The reference section is complete, although the examples do not always make a great deal of sense. The online documentation (help) is incomplete and omits entire sections, but it is (for the most part) aligned with the menu options available. You have the option of writing your own help files, although I must confess I have difficulty imagining why you would need a file to help you through a function if you already knew enough to write the help file.

In Conclusion

If the first part of this article seems overly negative, that was not the impression I intended. I simply wished to point out where there was room for improvement in the program. Some of the points are fine points, but when weighed together, I believe they will present you with the picture of a program that is well designed, and well implemented in the pursuit of a rather ambitious goal—the emulation of a Macintosh on an Apple II.

I recommend this program for Apple II users who do not make extraordinarily heavy demands of a spreadsheet program, and who like to use the Mouse as a pointing device.

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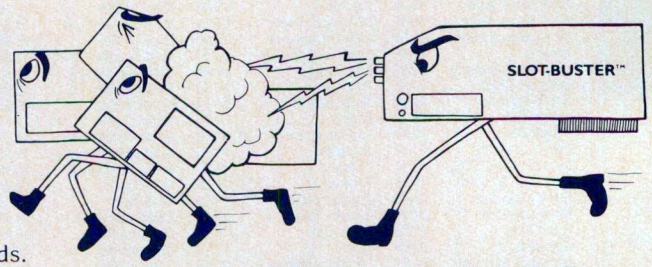

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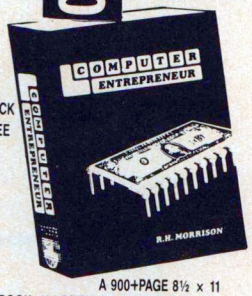

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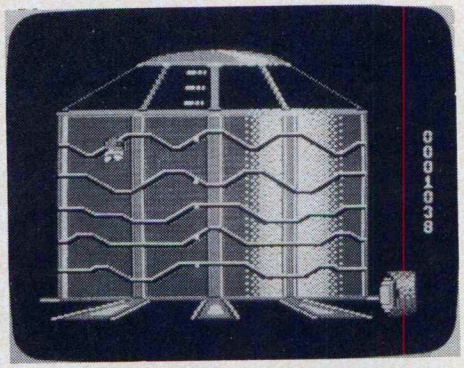

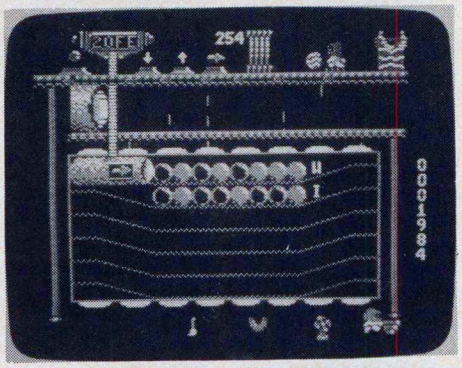

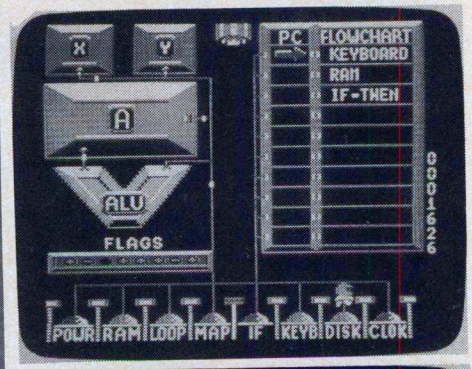

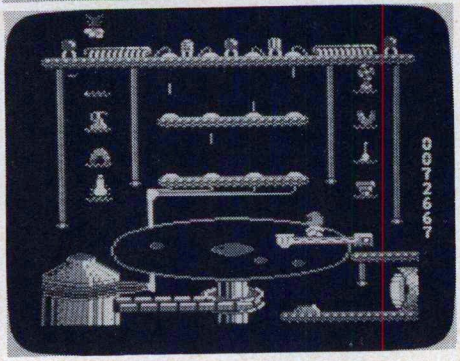

Clay Ruth

WILLY Byte in the Digital Dimension is a delightful new educational game that runs on all of the Apple II series computers. Besides being fun to play, it introduces the player to several fundamental concepts of a computer's internal operation.

Description

The player assumes the role of Willy Byte, whose mission is to guide a message (which may be from 1 to 6 characters long) from the keyboard to RAM and, finally, to the floppy disk. Each major section of the computer is in a separate room. Starting in the CPU, you set your next course of action before launching yourself toward the exit. Rooms can be selected after every step (manual mode) or automatically in a programmed format (flowchart mode). The flow chart, if desired, is developed by the player during Willy's first visit to the CPU.

The bits don't flow spontaneously. Willy has to help them along, pushing them down the data bus leading away from the keyboard and pulling them into the available memory locations. Inside the disk drive, Willy has to do a balancing act on the read/write head as it indexes to the proper track to write the message. Random failures of the power supply or the system clock can interfere with Willy's plans, making it necessary for him to visit these additional rooms and restore normal operation.

In manual mode, problem areas are spotted by observing the processor status flags. When flowcharting, the insertion of an IF-THEN statement will whisk Willy away to the problem area whenever trouble occurs. Wherever Willy goes, he has to be careful to avoid electrical impulses that traverse the circuitry. These will temporarily stun Willy, costing valuable time.

To further complicate Willy's mission, there's a nuisance known as Hex Luthor. This character does things that make computer lovers cringe! He rubs his feet on the carpet and hurls static charges at Willy's data. He dribbles water into the electronics. He drops magnets on Willy's floppy disk. He even uses a heat lamp to fry the circuitry. Willy has several tools available to counteract this onslaught, but Hex Luthor is a very busy chap who keeps Willy hopping. The primary mission has to be carried out a little at a time, in between Hex's antics. If Hex succeeds in destroying Willy's data, it is irretrievable.

Willy himself is immortal. He can take a lot of knocks and keep coming back for more. No matter what happens to the data, Willy will eventually be able to complete all the steps of his mission. You will then be given an efficiency rating that depends on the integrity of the data, the number of blunders made, the status of the system, and the time taken to complete the mission. Flowcharting helps improve your rating. The top eight scores are recorded on the disk, so you'll always know when you've topped your previous record. The first time you play, you'll find that a familiar cast of characters appear to have played before. You won't have any trouble beating them.

Evaluation

The game features superb, colorful, flicker-free animated graphics. The choice of colors is such that the game is easily played on a monochrome monitor. Control can be from the keyboard or a joystick, and this selection can be changed in mid-play.

While the joystick performs well for the climbing and jumping activities in most of the rooms, you may need keyboard control to conquer the power supply room. The play in this room is a platform-jumping game reminiscent of the Cubit/Q-Bert genre. Diagonal jumps may be required, and these can be difficult to pull off with a joystick. Fortunately, the arrangement of platforms can be modified at any time. Several preset patterns are included, and you can set your own by giving each tier a hexadecimal value (platforms will appear in the positions corresponding to the set bits). You could think of it as a Cubit Construction Set.

If your Apple's only soundmaking device is its internal speaker, you'll hear some occasional, minimal sound effects reminiscent of Raster Blaster. To enjoy the full experience of Willy Byte in the Digital Dimension, you should have a Mockingboard. This hardware product of Sweet Micro Systems, Inc. is available in three versions: A, C and D. The A and C Mockingboards are for the Apple II/II+/IIe, while the Mockingboard D is for the Apple IIc. All of them include stereo music and sound effects. The C and D boards also include a speech synthesizer. The A board can be upgraded to a C by adding a package called B. Prospective purchasers of Willy Byte should note that this game does *not* support the Mockingboard D, due to lack of memory space for the IIc serial port drivers. It was designed to be used with a Mockingboard C in slot 4, and the sound effects (but not speech) will work with a Mockingboard A or the older Sound II. The old Sound I or Sound/Speech I will give you only half of the sound effects and none of the speech. Any Mockingboard in a slot other than 4 will remain silent.

Data Trek has done a commendable job of utilizing the Mockingboard C. Willy Byte and Hex Luthor speak to you, each in his own unique voice. The game is loaded with music and spectacular sound effects. Of course, if you need peace and quiet, you can disable the sound by pressing ctrl-S. But, once you've heard this game on a Mockingboard-enhanced Apple, you'll want to hear it all the time. The well-executed sounds merge with the splendid graphics to create an unforgettable experience.

The documentation Data Trek supplies is unusually good for a game. A reference card summarizes the commands, and a booklet describes the activity in each room. At each turn of a page you see a room's game description on the left, and on the right you get an explanation of the analogy between the game activity and the workings of a real computer. This greatly enhances the game's educational value.

The disk is covered by a 90-day warranty, during which defective media will be replaced free of charge. After the warranty expires, a nominal $5.00 replacement fee applies. Although the program itself is not covered and is sold "as-is," you needn't worry about this. The copy I reviewed was, so far as I could tell after hours of use, bug-free. Actual screen photos decorate the back of the package, so you can see the graphic displays before you make the purchase.

Willy Byte in the Digital Dimension is entertaining, educational, and enjoyable. I recommend it for anyone who enjoys games, regardless of computer literacy. If you don't understand your computer you'll gain some insight, and if you already know what goes on in there you'll gain a great appreciation for the programming effort that went into this game. You can't lose with Willy Byte.

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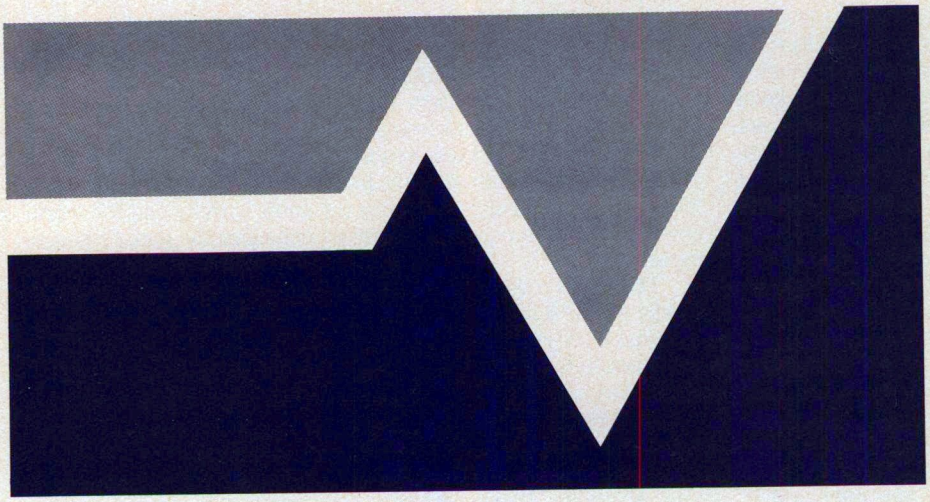


Bruce F. Field

EXPANDED PRINT ON THE MX-80

I had a question a few months ago from a user who was only able to print one line of expanded print on an MX-80. When a new line was started, the printing reverted to standard printing. Mike Firth wrote to me suggesting that the problem was with the MX-80 ROMs. Thomas Vallee and Lee Raesly wrote and added to Mike's answer. Unless you have a very old MX-80 that does not have the Graftrax ROMs, there are two ways of turning on expanded print. PRINT CHR$(14) turns on the expanded print and turns it off at the end of the line. PRINT CHR$(27) "W"; CHR$(1) turns on expanded print and leaves it on. Finally, PRINT CHR$(27) "W"; CHR$(0) turns expanded print off.

APPLEWORKS AND PRINTERS

I received a rather lengthly letter of tips on AppleWorks and printers from Gene Carter that I have not seen published before. I'll pass some of them along and hope they help with some of those frustrating little problems.

"The earliest versions of AppleWorks in ProDOS had an error that fouled things up when printing with an interface board such as the Grappler. Thus, if 80N prints at the top of your first page and you have the earliest version, your dealer should give you a new copy of AppleWorks, copied onto your disks. That is what I got.

"With the newer version I only got "0N" printed on the first page with the Panasonic 1091 printer. Since this sometimes happened with Screenwriter II in DOS 3.3, I blamed the Panasonic. True, you can solve the problem by ejecting the first page or using Snopak, but still. . . Anyway, it took lots of effort to find that the problem was a combination of the Panasonic and the Grappler. You can fix this by deleting the 80N code using the Custom printer option in AppleWorks and/or removing the Grappler as the specified interface card. That solves the word processor problem, but the data base output will be junk with strange spaces and carriage returns in various places. It turns out you have to send a Control-I 0N to the Grappler if you want it to completely stop sending carriage returns; then the only way the printer can get a carriage return is from AppleWorks, which is exactly what you want. Why I didn't have this problem with my Epson FX-80 I do not know. Lesson: *be careful with an interaction between software, printer interface cards, and printers.*

AN APPLEWORKS QUIRK

"Within AppleWorks there is a particularly absurd action of the Find (or Find and Replace) function. Essentially, anything you had previously sought to find is left there unless you first clear the buffer, next time, using Control-Y (I believe). Thus, "find marty." Next time, "find sue." You will fail to find it because the system is searching for "sue(CR)y." Put spaces after sue" and then backspace to the end of your search string and type a carriage return. Thus, "sue (CR) space space" will work, whereas "sue space space (CR)" will not. This information is in the tutorial but not in the manual, nor is it in the summary tables at the end of the manual. No salesman understood this, which says something about customers/salesmen. Going to the end and deleting backwards may work, but Control-Y is easier."

CONVERTING TO DVORAK

A couple of months ago I had a question on converting the standard keyboard on the Apple *II*e from the QWERTY (or Sholes) to Dvorak layout. My instructions were backwards and guaranteed to lock you into the QWERTY layout. The correct solution is to cut the little hourglass shaped solder pad on your motherboard that is marked X2 so that it is in two pieces. This pad is located on the right hand side of the motherboard just behind the keyboard connector. Take a sharp knife and cut through the solder at the narrowest part of the hourglass. Then solder a small piece of wire from the half of the hourglass nearest the rear of the computer and solder the other end into one of the little holes (the one nearest the rear of the computer) in the rectangle marked J19. You can use a single-pole, double-throw switch to connect the rear half of the hourglass to the other half, or to J19 if you want to be able to switch back and forth. If you don't want to cut traces on your computer, you can solder the wire from the rear hole of J19 to either the X2 hourglass pad or to the other hole of J19 *and* remove the video ROM and bend pin 18 out so it doesn't fit back in the hole in the socket. It is not clear to me exactly why this second method works, but it has been tested in two computers and functions properly. The first method is preferable in my opinion. My apologies to those of you who tried my original solution.

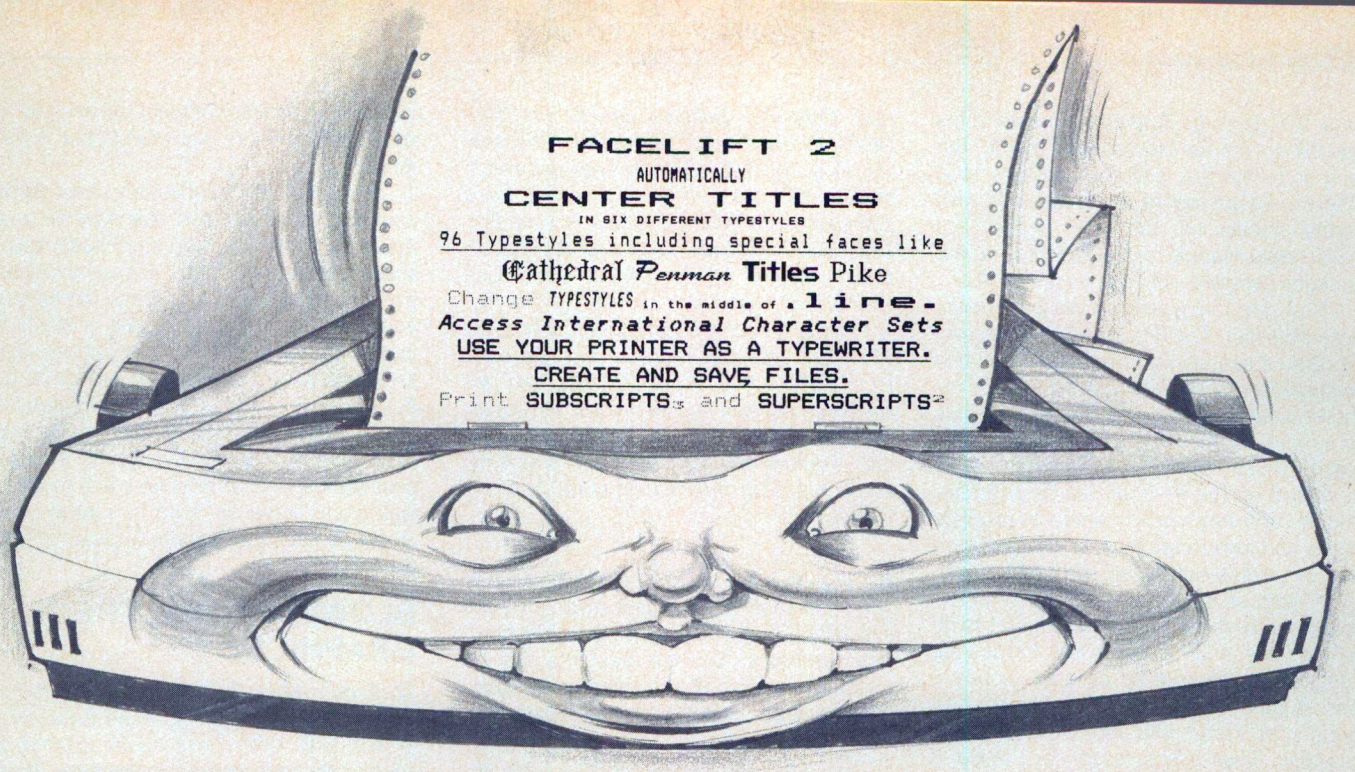
UPGRADING YOUR II+

Q. *I am the owner of an Apple II+ that I've customized to be portable (64K already installed). There are times when I regret having a II+ instead of a IIe. To solve this dilemma, without having to buy a new computer, I am contemplating a hardware updgrade and the modifications necessary to bring my II+ up to an equivalent IIe, if at all possible.*

Though I am capable of performing such surgery myself, the real problem exists in finding a suitable published reference that spells out the technical differences between these two models, and supports the information with schematics and other details needed to plan and execute such an upgrade with safety and accuracy.

The two areas that I'm particularly interested in knowing about are the IIe "Auxiliary Slot," the II+ "Slot 0," their conventions and differences, and the II+ lowercase/uppercase "shift key mod".

A. Probably the best reference source for schematics and functional description of the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//e is the *Apple //e Reference Manual.* This manual covers the hardware of the //e, the new soft-switches, and the auxiliary slot. There are a number of Apple manuals with similar names. On the cover, mine says "Reference Manual for the //e Only," and it contains complete schematics of the //e.

Now that I've given you the good news, here's the bad. The //e contains two custom integrated circuits that implement the new features, and these will be hard to copy using conventional circuitry. You may be able to emulate some of the //e features, but it will be difficult to be 100% compatible. The keyboard on the //e is of course different, and the shift key actually works to produce upper and lower case letters. To do this on the II+, requires changing the keyboard encoder chip or inserting another circuit between the keyboard and the computer to do a "shift key mod" in hardware. In the long run, it may actually be cheaper to buy a bare-bones //e, as all of your existing peripheral cards will work in the new machine. Your 16K memory card in slot 0 cannot be used, but since the //e comes with the extra 16K already installed, you won't need it anyway.

EMULATING OPEN AND CLOSED APPLES

Q. *I have a Franklin Ace 1000 and would like to be able to run AppleWorks on it. I've read Cornelius Bongers' article on "ProDOS—Pros and Cons" in the May 1984 issue of* Call -A.P.P.L.E. *where he suggested a fix to the ProDOS disk so it would load on a Basis 108 (and the Franklin). I've done this and ProDOS does load. I also read your A.P.P.L.E. Doctor section in the March 1985* Call -A.P.P.L.E. *which lists another possible fix.*

I'd like to be able to run AppleWorks on my Franklin, but the manual says to press CONTROL-Open Apple-RESET and the computer will then read the instructions on the startup disk. As you know, the Apple //e is the only machine that has the Open and Close Apple keys. Any information would be appreciated.

A. The //e has a special feature that when you press CONTROL-Open Apple (or PB0) and RESET all at the same time, the computer re-boots. You can simulate this by turning your Franklin off and then on again. This just loads in DOS and runs the greeting or startup program.

The Open and Closed Apple keys are easy to emulate on any Apple compatible machine that has a game I/O port. The Open Apple key is connected to switch input 0 (PB0) or pin 2 on the 16-pin game I/O port. Similarly, the Closed Apple key is connected to switch input 1 (PB1) or pin 3 on the game I/O port. If you have a set of paddles, you already have Open and Closed Apple keys, just use the paddle buttons. This will work for all the cases except the one you've stated above where you want to use it with RESET.

Actually I don't understand why Apple used the game I/O port this way because this leads to the "my computer won't run on a messy desk syndrome." If you have some paddles or a joystick pushed to the back of your desk and buried under a stack or papers or books, one of the buttons may accidentally be pushed. This will cause the //e to either re-boot or perform a diagnostic test when CONTROL RESET is pushed. (This feature does, however, make a certain columnist sound omniscient when he gets a call from someone with a non-working Apple //e and he tells them to clean up their desk.)

SLOWING DOWN THE GRAPHICS

Q. *I am reading the Graphics Tool Kit (Part 1) by Randi Rost in the April 84 issue of* Call -A.P.P.L.E. *After I entered the code for the four listings and ran the demo program, the hires colors filled the screen so fast that I couldn't even count the seven colors before the screen finally turned white. I wanted to get back to the Lisa assembler and did not know how. I therefore pressed control-RESET on my Apple //e and this did the job. Is there another way to do this? Can one change the demo program so that at the end it will place you in the monitor?*

Is not the demo program equivalent to the

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following Applesoft program?

```
10 TEXT : CLEAR
20 HOME
30 HGR
40 FOR I = 0 TO 7
50 HCOLOR = I
60 HPLOT 0,0
70 CALL 62454
80 VTAB 22 : PRINT "COLOR
   VALUE = ";I
90 NEXT I
100 END
```

Running this program will display all the colors for a sufficient time. If I want a delay after each colorfill, what changes should I make in the demo program of Randi Rost?

A. Yes, your Applesoft program is equivalent to Randi's machine language demo program except for the fact that it runs much more slowly. The whole point of Randi's program is to demonstrate how quickly the entire screen can change color. To do this, he does not use the hi-res graphics software built-in to the Apple, but instead creates a table of memory locations corresponding to screen addresses to permit rapid access to the hi-res screen. The status of the dots (on or off) on the hi-res screen are stored in memory in a regular, but not consecutive, order. To determine which memory location controls which dot on the screen requires a calculation that takes some time. It is much quicker to do as Randi does, compute all the possible combinations and store them in a table for later use.

With your Applesoft program, the screen does not appear to change color all at once, horizontal bars of the new color appear within the old color. Randi's program makes this change appear more instantaneous. If you must slow Randi's routine down, the following delay program can be inserted between lines 22 and 23.

```
        LDY   #50
LOOP1   LDA   #196
        JSR   $FCA8
        DEY
        BNE   LOOP1
```

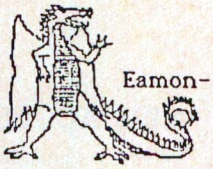
Replace the original line 23 with BEQ LOOP. The above routine calls a built-in delay routine in the monitor at $FCA8. This routine provides a delay time related to the value (A) of the accumulator, where the time is 0.000001023(2.5AM2 + 13.5A + 13) seconds (decimal values). For values of A from 0 to 255 the time is 0.000029667 to 0.169836414 seconds. In my routine above, I added an additional outer loop that calls the delay routine a number of times (the value in the Y-register) to increase the delay.

Pressing CONTROL-RESET is an okay way to re-enter the Lisa assembler, as this resets the screen to text and does a few other housekeeping chores to restore the Apple to a predefined state.

Software for the

EAMON

UNIVERSE



Eamon- [ee-men] adj: of or relating to the Adventure Gaming system created by Donald Brown, in which a player builds characters by sending them out on adventures. *eg:* "Super Eamon enhances the Eamon universe."

Little Green products are presently available for Apple II computers. Eamon Public Domain software will be available for IBM & C-64s.

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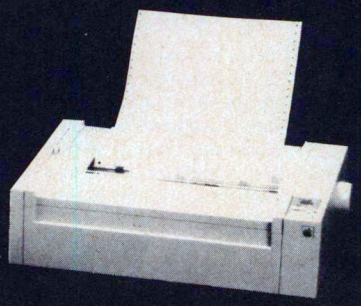

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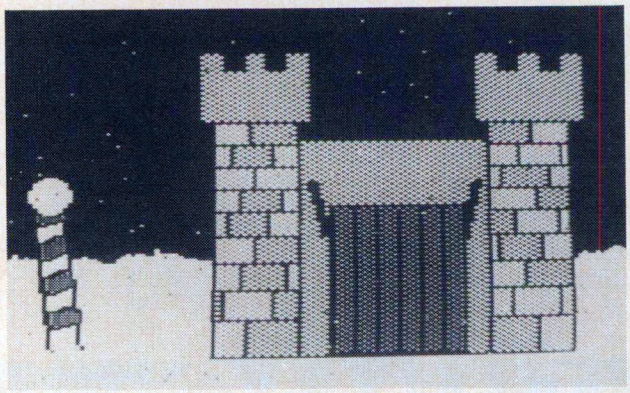
The Marketplace

The following items are selected by our editorial staff from the large number of product announcements and news releases sent to us daily. They are presented solely to keep you informed about the current market for Apple related hardware and software. As we have not tested many of these products, appearance here does not necessarily represent endorsement or recommendation by A.P.P.L.E. Further information about items appearing in The Marketplace can be obtained through the Reader Service Card. If you contact any manufacturers directly, please mention that you learned about them in *Call-A.P.P.L.E.*

A CHRISTMAS ADVENTURE



BitCards Inc. announces the release of an enhanced version of A Christmas Adventure. Written especially for the upcoming holiday season, the program is structured like a text-and-graphics adventure, set in and around Santa Claus' ice-castle at the North Pole. The player discovers at the outset that Santa has mysteriously disappeared, and with Christmas only hours away, his annual gift-delivery run is in grave jeopardy! This mission is clear: Explore the many rooms of the castle and outbuildings, unravel the mystery of Santa's disappearance, find and free him, and thus "save" Christmas.

Bitcard has also included an easy-to-use customization utility in this current release. The utility enables the purchaser to custom-program A Christmas Adventure such that the recipient will discover several personal references while proceeding through the program.

The optional customization routine allows the sender to incorporate a personal holiday greeting message into the culminating sequence of the program. Available on disk for Apple II computers. The program can be ordered directly from BitCards at $24.95 plus $3.00 S & H.

BitCards Inc., 30 W. Service Road, Champlain, NY 12919, (514) 274-1103.
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ANOTHER USE FOR THE APPLE II MOUSE

International Solutions, Inc. announces Mouse Word, a new word processing product for the II computers. Along with using mouse generated commands, Mouse Word has time saving features such as mail merge and mathematic calculations. Documents created with Mouse Word can also be combined with spreadsheets created on Mouse Calc.

Automatic log-on commands for popular services such as Dow Jones, The Source and CompuServe are built in, and manual procedures are clearly explained. The program can eliminate repetitive typing by merging form letters with name lists created on Mouse Word or any ProDOS based data base program. It also saves the user time by performing mathematical calculations within documents; or it can use mail merge and the calculator together or standardized billings. The package include master and back-up program disks, an instruction manual and a 90-day warranty. Price: $129.95.

International Solutions, Inc.,a 910 West Maude Avenue, Sunnyvale, CA 94086, (408) 773-0443.
Circle 51 on Reader Service Card

NEW ACCESSORIES FOR APPLEWORKS

Pinpoint Publishing's new desktop utility program for Apple II computers provides AppleWorks users direct access to nine desktop accessories: a notepad, a Quicklabel, a typewriter, a calculator, an appointment calendar, a cut an paste function, a communications window, a telephone dialer and a function for merging text and graphics.

These accessories can be accessed from within AppleWorks through "pop-up" windows, so users can stop what they're doing in AppleWorks to jot down a note, address a letter, or call a friend; and then easily return to where they left off in AppleWorks. In addition, Pinpoint uses the same commands as AppleWorks, so AppleWorks users don't have to learn anything new to use Pinpoint.

Each Pinpoint accessory is carefully designed to take full advantage of Apple II peripherals and accessories, including Apple's new ImageWriter II printer, Apple Personal Modem, and Apple II memory Expansion Card.

Pinpoint retails for $69.00.

Pinpoint Publishing, P.O. Box 13323, Oakland, CA 94661, (415) 530-1726.
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EYES FOR YOUR COMPUTER

DIGITAL VISION, INC., announces the introduction of COMPUTEREYES, a video acquisition system for the Apple *IIc* computer. It is a slow-scan device that plugs into the *IIc*'s Serial Port 2 and Joystick Ports, and connects to any standard video source (video tape recorder, video camera, videodisk, etc.). Under simple software control, a b/w image is acquired in less than six seconds. Unique multi-scan modes also provide realistic grey-scale images.

The software is provided with the system and includes: machine language image capture routines; a menu-driven executive that provides everything you need to capture images; and image save-to-disk capability. To encourage application development and promote ease of use, the software is not copy-protected. Images acquired with COMPUTEREYES can be loaded into many of the popular graphics packages available for the Apple, such as "MousePaint," for further manipulation, printing, etc.

A software enhancement is available which supports the acquisition of double hi-res images at $15 additional and are compatible with programs such as "Beagle Graphics" and "Dazzle Draw." Enhancements are also available to acquire images that are compatible with "Print Shop" and "Newsroom," also priced at $15 each.

The COMPUTEREYES package includes interface module, complete software support on disk, owner's manual, and a one year warranty. Also available for the II and *IIe*.

DIGITAL VISION, 14 Oak Street, Suite 2, Needham, MA 02192, (617) 444-9040.
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DESIGN YOUR OWN COMPUTER GAMES

Designed for experienced BASIC programmers, ACTION GAMES FOR THE APPLE explains solid game design and programming techniques—and includes 11 original games that show these techniques in action. The authors include explanations and examples of hi and lo-res graphics, joystick and paddle input, game timers, and suggestions for enhancements and modifications of each game. Price: $12.95.

Features

- Shows you how to create your own computer games on the II +, *//e*, and *//c*.
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Scott, Foresman and Company, 1900 East Lake Avenue, Glenview, IL 60025, (312) 729-3000.
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BRINGING CP/M TO THE *//C*

CIRTECH announces the CIRTECH *//c* CP/M PLUS SYSTEM which consists of a Z80 hardware Module and an advanced version of the CP/M Plus operating system configured specifically for the Apple *//c*. This system allows *//c* owners to run any CP/M programs.

The CP/M Plus operating system contains many unique and exciting features:

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- Support for a high capacity external disk drive.

CP/M Plus is fully compatible with CP/M 2.2. Also available is a CP/M Plus Programmers Pack containing a full set of programming utilities and reference manuals. Price: $274.95.

CIRTECH (UK) LTD., Currie Road Industrial Estate, Galashiels, Selkirkshire, Scotland, TD1 2BP, Telephone (0896) 57790.
Circle 55 on Reader Service Card

GRAPHICS FOR THE NEW PERIPHERALS

Broderbund Software announces that its two graphics packages, DAZZLE DRAW and FANTAVISION will support Apple Computer's new *peripherals. DAZZLE DRAW will work with the ColorMonitor //e* and *//c*, the ImageWriter II printer and the UniDisk 3.5 disk drive. FANTAVISION will run on the ColorMonitor *//e* and *//c*.

DAZZLE DRAW

DAZZLE DRAW is a complete illustration package for the Apple *//c* or 128K Apple *//e* which uses an interface similar to the Macintosh, complete with mouse control, icons, pull-down menus, multiple windows and cut-and-paste editing. It is compatible with a mouse, graphics tablet, KoalaPad or joystick. Price: $59.95.

FANTAVISION

FANTAVISION is a full-screen special-effects/animation generator for the Apple II computers. It also incorporates mouse control, icons, pull-down menus, and cut-and-paste editing. With FANTAVISION the computer fills in the frames between objects you draw and changes the shapes giving them life-like motion. Users can move and manipulate drawings, make specific objects trace, wiggle and bounce. Price: $49.95.

Broderbund Software, #2 Vista Wood Way, San Rafael, CA 94901, (415) 479-1170.
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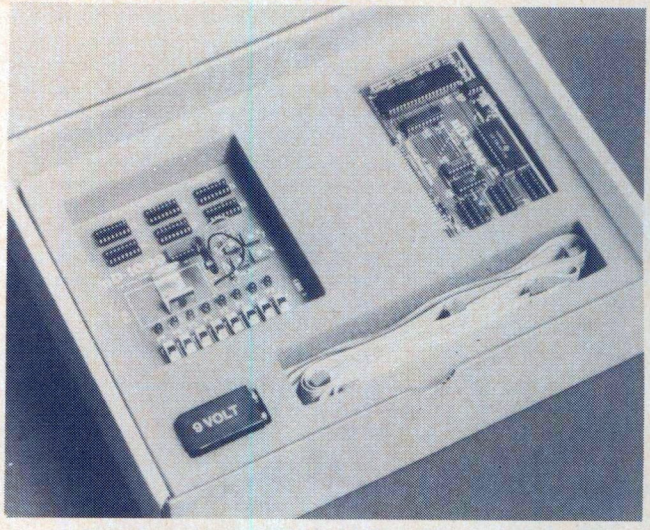
INPUT/OUTPUT SYSTEM



The uD-1000 I/O system, designed to simplify input/output for the Apple II plus and Apple *//e* computers, now is available from MicroDimensions. The uD-1000 plugs into one of the Apple's slots and provides eight digital inputs, eight digital outputs and eight analog inputs. A User Interface Module simplifies testing of user-developed hardware and software. The uD-1000 I/O system also includes The Hook, on a 5¼" floppy disk, which allows the use of Applesoft BASIC, without the need for "POKE" or "PEEK" instructions. Standard BASIC variable names then are used to provide the values of each of the I/O channels. A 60-page manual is included. For further information, please contact:

MicroDimensions, 4780 Beidler Road, Willoughby, OH 44094, (216) 944-4200.
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EXPERIMENTS AND SIMULATIONS

A new software house called PSI 'N' EYE produces Apple II programs for those who teach behavior in Psychology or General Biology classes. The programs, which include Experiments (students are Subjects) and Simulation (students are Experimenters), are designed for use at the high school and college level. No knowledge of programming, or even of the Apple, is required for the instructor. The Teacher's Guides give enough background on the psychology involved that instructors need not fear using programs on topics outside their areas of expertise. Extensive use is made of the graphics capabilities of the computer. Price: The ILLUSIONS PACK $60.00, a demo disk—The SAMPLER—is available for $10.00 (FL residents add 5% Sales Tax) plus $1.50 shipping. The SAMPLER includes one of the six experiments, an illusions demonstration, and samples from other PSI 'N' EYE programs.

PSI 'N' EYE, PO Box 826, Mango, FL 34262, (813) 626-8821.

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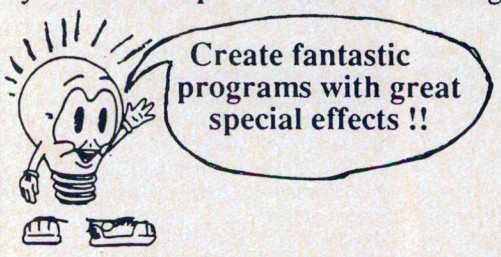
THE P.A.C.K.

(Programmer's Assembly-language Construction Kit)

by **Bob Bishop** with Lucia Grossberger



The **P.A.C.K.** is a programming construction kit that gives you a multitude of building blocks (subroutine modules) and the tools (Editor, Assembler and Linking Loader) to put these blocks together to build or add to your own programs. These tools can be used to create your own library of subroutines.

An exciting tool thats easy to use !

The documentation provides clear and complete instructions for using the Editor, creating relocatable files, running the Linking Loader, and using the subroutine libraries.

SYSTEM REQUIREMENTS:
Apple II series of computers with 48K

PRICE: $49.95 plus $3.00 shipping
(sales tax as applicable)
Specify DOS 3.3 or ProDOS when ordering.

PUBLISHED BY:
INTERACTIVE ARTS
2715 PORTER St.
SOQUEL, CA 95073
(408) 475-7047

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REPORT CAPABILITIES FOR APPLEWORKS

Megahaus Corporation announces ReportWorks which enables users to import data from AppleWorks database and spreadsheet files to create reports, tables, lists and even fill out full page forms. ReportWorks represents a significant enhancement to AppleWorks reporting features by adding powerful math, file lookup and sorting capabilities.

To create a report, the user selects "Create Report Layout" from the file card menu. Using the keyboard you then may:

- Assign fixed text or "captions".
- Define what type of information will be placed within each field (text, numbers, etc.).
- Define the format for the information such as "numbers" or "currency" (ReportWorks automatically places a "$" sign to the left of the number), and number of decimal places.
- Define the "source" from which the information will come, such as AppleWorks database or spreadsheet file(s) or calculations(s).

ReportWorks then performs all calculations, such as adding taxes, calculating discounts, looking up prices and totaling invoices. ReportWorks also gives users the ability to repeatedly sort, search and select information to be included in the report. The search and sort criteria may be on any field(s) and may be as general or as specific as required. All printing is done in ReportWorks so there's no need to go back into AppleWorks to print your reports. Price: $125.00.

Megahaus Corporation, 5703 Oberlin Drive, San Diego, CA 92121, (619) 450-1230.

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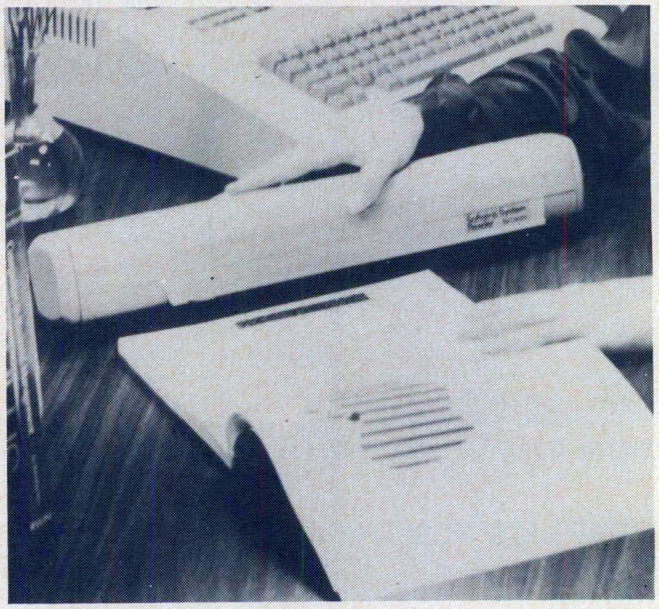
EFFORTLESS INPUT



The Cauzin Softstrip System is a completely new way for people to receive, enter, store and manipulate software and data (including graphics and sound) on their personal computers. The system has two elements:

- The Softstrip data strip which is computer code printed through a unique patented encoding technology.
- The Cauzin Softstrip Reader, a hand-operated optical-electronic scanning device which automatically reads the information from the data strips into any computer.

The Softstrip System makes print a whole new source of computer useable material. Now computer users will be able to obtain software from printed books, magazine, and newsletters without having to use the keyboard. Businesses will be able to communicate computer data through the mails without excessive costs and without special production of separate magnetic materials.

To find out more about the Softstrip System contact:

Cauzin Systems, Inc., 835 South Main Street, Waterbury, CT 06706, (203) 573-0150.

Circle 60 on Reader Service Card

MOUSE/PRINTER CONNECTION

The MOUSE/PRINTER CONNECTION is a menu-driven program which allows you to install custom printer drivers on copies of your Mouse-Paint disk.

This program comes with complete documentation on the disk as well as provision to print instructions for hard-copy reference. It also offers you several customizing options. With an Epson printer you can choose single or double size printout—double size will be rotated 90 degrees on your Epson. You can also choose to print your pictures in inverse, centered or left margin justified, and you can choose to send a form feed to you printer at the end of each picture.

The disk is completely copyable and the program requires that you have an Apple II + or *IIe* capable of running MousePaint, an an Epson printer with graphics capability. The disk also includes the handy FILER and CONVERT utility programs for ProDOS.

Price: $7.95. *E-TECH SERVICES, P.O. Box 2061, Everett, WA 98203, (206) 337-2370.* Circle 61 on Reader Service Card

THE RESEARCH REPORTER

East Brunswick, NJ—Computer Publishing Resources, Inc. announces the release of its first software package, The Research Reporter. It is designed to work with the Apple II family of computers with 48K and one or two disk drives.

Designed for efficient filing and analysis of research questionnaire responses, demographic studies and any other research projects that are questionnaire based, it features automated tabulations and crosstabulations, detailed numerical analyses, and on-screen or universal printer outputs.

The program was designed for use by a nontechnical operator with prompts and explanations to guide the operator. In addition, built-in quality controls monitor the operator's entires to prevent common errors. The user is informed at all times as to what the computer is doing and what it expects of the person using it. The user has the option of skipping functions, correcting errors and deciding to quit any routine at any time. There are special options available to the experienced user for rapid entry of data and custom reporting.

The Research Reporter uses a special filing technique to conserve disk storage space and contains a special space-check function allowing the user to determine about how many records each data disk can store for the particular project in question.

Price: $195. *MICROHOUSE, INC., 4379 William Penn Highway, Bethlehem, PA 18017, (800) 523-9511* Circle 62 on Reader Service Card

SUPER 6502's

Bringing 16-bit performance to 6502 designs, Western Design Center announces enhanced versions of the 6502, the W65C802 and W65C816 CMOS 8/16-bit microprocessors. While the W56C802 is pin for pin compatible with the older NMOS 6502 and WDC's W65C02, the W65C816 includes the ability to address up to 16 Mbytes of memory and provides many additional hardware features. Both the W65C802 and the W65C816 operate in two software selectable modes; native and emulation.

In the emulation mode, they behave exactly like the 6502 and can run all 6502 software without modification. However, when the native mode is activated, the microprocessor's accumulator, ALU, X and Y index registers and the stack pointer is expanded to 16-bits. The new processors also include a 16-bit direct page register to augment the direct page addressing modes. On the W65C816, separate program and data bank registers extend the X,Y and program counter to cover the entire 16 Mbyte addressing range.

Besides the thirteen 6502 addressing modes, the family provides eleven new modes including stack relative, relative long and absolute indexed direct addressing. The instruction set has also been expanded to include thirty three new instructions including push effective address, block move, swap bytes and bit test and reset.

New hardware features of the W65C816 include a new abort input which allows aborting an instruction without affecting the internal registers, a vector pull output which allows true vectored interrupts and multiprocessor support. The W65C802 and W65C816 are implemented in 3 um silicon gate CMOS and are packaged in a 40 pin plastic DIP. They draw typically only 8ma at 4MHZ. Faster versions will be available soon. *THE WESTERN DESIGN CENTER, INC., 2166 East Brown Road, Mesa, AZ 85203, (602) 962-4545.* Circle 63 on Reader Service Card

VERSATILE INTERFACE FOR THE *IIe*

The BusinessCard can drive a serial printer, operate a 300 or 1200 baud modem, keep track of the time and date, do print buffering, and print black and white or color graphics and text. A version of the BusinessCard for parallel printers is also available. By adding the three optional buffer chips, the BusinessCard can have 16K or 64K memory. With 64K of memory the BusinessCard can store up to 20 full pages of text and/or graphics. the hi-res graphic screen printing commands include color, windowing, zoom (magnificaion), rotate, and inverse. Text formatting features set margins, page titles, page numbers, line and page length, plus more. Price: $219.95—includes a printer cable. 16K Buffer Kit is $39.95; the 64K version is $79.95. Parallel version is priced at $249.95.

Street Electronics Corporation, 1140 Mark Avenue, Carpinteria, CA 93013, (805) 684-4593. Circle 64 on Reader Service Card

DESKTOP ORGANIZERS FOR APPLE II'S AND MAC

MicroRain introduces Desktop Savers which cut in half the desktop space, or "footprint," required by a complete computer system. Desktop Savers position the printer conveniently over the computer where it can't get in the way, and provide convenient storage areas for manuals and other computer-related items. Desktop Savers help organize and hide unsightly cables while allowing the user to always see how much paper is left for the printer.

The Desktop Saver is available for both the Macintosh and Apple II computers. For the Macintosh, there's the MacStation that mimics the color, texture, and unique looks of the Mac. It also has vents to keep it cool. For the Apple II's there's UniStation II which comes in classy clear, LASER-CUT Acrylic. All Deskop Savers assemble in minutes without tools or glue. Price: From $95.00 to $175.00.

The MicroRain Corporation, P.O. Box 96008, Dept. 150, Bellevue, WA 98009, (206) 462-1511. Circle 65 on Reader Service Card

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ASTRONOMY AID

The Minnesota Educational Computing Corporation (MECC) announces Sky Lab, an astronomy program which helps young people understand events in the sky such as the arrival of Halley's comet. With Sky Lab, students can analyze a set of observations and explain motions such as the Earth's rotation, the Earth's revolution, the movement of Mars and Venus, and the movement of Halley's comet.

Sky Lab gives you the opportunity to make observations from two different vantage points; the backyard view and a view from space. This program operates on all Apple II computers with at least 64K of memory and Applesoft BASIC in ROM. Price: $49.99.

MECC, 3490 Lexington Avenue North, Saint Paul, MN 55126-8097, (612) 481-3500. Circle 66 on Reader Service Card

COLOR GRAPHICS INTERFACES

Video-7 Incorporated introduces three new graphics and text adapters which bring high resolution color graphics to the Apple II family of computers. The Enhancer Series allows Apples to run with IBM-compatible RGB (Red, Green, Blue) monitors.

The Enhancer Series—the Color Enhancer and the Screen Enhancer—is compatible with all Apple II software. The Color Enhancer provides 16 distinct levels of color and 16 shades of gray to the Apple *IIe* and *IIc*. It allows readable 80-column text and 16-color graphics to be displayed on the same monitor. Broderbund's enhanced Dazzle Draw, which enables users to create pictures, graphs, and charts in 16 colors and 30 patterns is available with the Color Enhancers. The Color Enhancer and Dazzle Draw for the *IIe* is priced at $179.95; for the *IIc* $129.95.

The Screen Enhancer provides 16 shades of gray to the monochrome interface. The *IIe* model is priced at $129.95 and adds 64K of internal memory and 80-column text capability in addition to the gray scale. The *IIc* model, priced at $79.95 brings "colors" to the monochrome monitor through sharp grayscale differentiation.

Video 7, 550 Sycamore Drive, Milpitas, CA 95035, (408) 943-0101.
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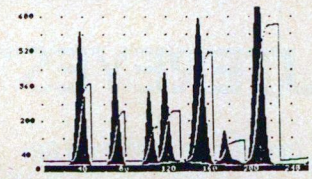
NEW

Scientific & Graphic Software For Your Apple* II Computer



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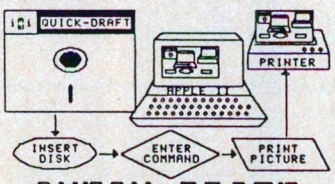

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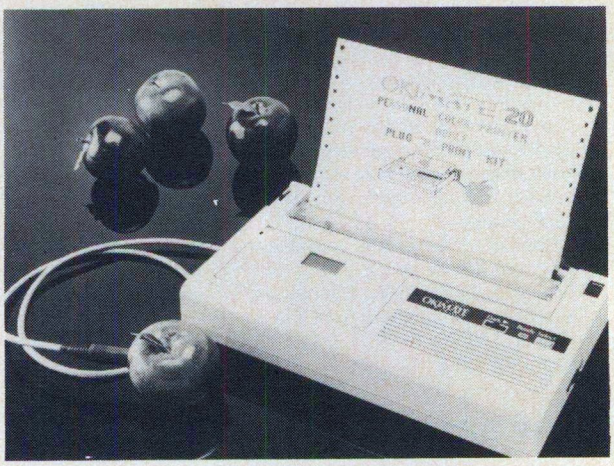
COLOR PRINTER FOR *IIE* AND *IIC*



With the OKIMATE 20, the ribbon transfer color printer from Okidata, Apple users can now print over 100 different shades of color, even on acetate for overhead projection slides. In the word processing mode, OKIMATE 20 prints 80 characters per second in standard type, with letter quality capabilities at 40 cps. Users also have the option of several type fonts, including wide print, bold face, fine print and italics. Even underlining, superscripts and subscripts are standard features on the OKIMATE 20.

OKIMATE 20 with a 24-element printhead, built-in friction and pin feed paper handling mechanism, variable-width tractor feed for computer paper, and 8K buffer. Users can print in either 80 standard columns or 136 columns using condensed type.

Each printer comes with a Plug 'n Print package, and Color Screen Print software, enabling a quick and easy interface with Apple *IIe* or *IIc* computers. The kit contains an interface module, data cable (serial version), computer paper, "clean hands" color and black ribbon cartridges and complete instructions. The printer is small, lightweight and transportable, yet rugged enough to withstand constant use. It is backed by Okidata's 90-day guaratee on parts, labor and printhead. Price: OKIMATE 20 and the required Plug 'n Print interface package $258 for the Parallel version and $268 for the Serial version. Either version is available at authorized Okidata dealers. Circle 68 on Reader Service Card

Call 1-800-OKIDATA for the nearest Dealer. OKIDATA, 532 Fellowship Road, Mt. Laurel, NJ 08054, (609) 235-2600, TWX (710) 897-0792.

MACHINE LANGUAGE FOR BEGINNERS

COMPUTE Books' new release, *Apple Machine Language for Beginners,* is an introduction to machine language programming that includes LADS, a sophisticated labeling assembler, for the II-series computers.

The book contains everything a beginner needs to learn 6502 (65C02) machine language, including a disassembler, an easy-to-use chart for quick conversion, a library of frequently used subroutines, and many understandable examples and comparisons with already familiar BASIC programming methods.

There is a dictionary of all major BASIC words and their machine language equivalents. This section also contains many sample programs and illustrations of how all the familiar BASIC programming techniques are accomplished in machine language.

A main feature of *Apple Machine Language for Beginners* is the LADS assembler. LADS is a full-featured, commercial-quality, label-based programming language which supports pseudo-ops, labels, multiple statements on a line, named variables, and remarks. It offers a choice of two modes: disk-based for linked files or ultra-fast memory-based assembly. It is written for all Apple II's, DOS and ProDOS. Price: $14.95. *COMPUTE! Publications, Inc., 324 W. Wendover Avenue, Suite 200, Greensboro, NC 27408, (919) 275-9809.* Circle 69 on Reader Service Card

FREE APPLE II BOOK CATALOG

Witt's End has published the Apple II series Book Catalog. The catalog contains complete descriptions and illustrations of 57 Apple II books from 12 different publishers. The catalog is free to anyone who wants it by writing or calling.

WITT'S END, 42 Morehouse Rd., Easton, CT 06612 (203) 254-0728.
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Price: $99.95. *EZWare Corporation, 29 Bala Avenue, Bala Cynwyd, PA 19004, (215) 667-4064.* Circle 71 on Reader Service Card

MAC MAIL

Aegis Development, Inc., announces their new telecommunications program for the Macintosh, MAC MAIL telecom. This program is designed to be used between a Macintosh and any other computer, allowing the user to send and receive any kind of file either manually or unattended, to provide an address book database complete with the option of printing mailing labels, as well as an on-screen text editor which can be used to create messages to be sent at any time. Information and phone numbers for all of the most popular Bulletin Board Systems for the Mac, including Compuserve and The Source, Dow Jones NewsNet, Knowledge Index, Compucard, and more are also included. Price: $59.95.

Aegis Development, 2210 Wilshire Blvd., Suite 277, Santa Monica, CA 90403, (213) 306-0735. Circle 72 on Reader Service Card

NOVELS COME ALIVE

Telarium Corp. announces the shipment of three science fiction games now available for the Macintosh. In AMAZON the player is an agent for NRST a high-tech research firm. The goal is to locate the lost city of Chak and recover the emeralds.

DRAGONWORLD places the player in the role of a friendly hermit who tries to rescue a kidnapped friend. He encounters thieves, monsters, beggars and artists along the way.

In FAHRENHEIT 451 you are Guy Montag, a member of the Underground who tries to restore the world's freedom—freedom to read and think. The Apple Macintosh versions retail for $39.95, the Apple II versions $32.95.

Telarium Corporation, One Kendall Square, Cambridge, MA 02139, (617) 494-1200. Circle 73 on Reader Service Card

CAN YOU PREVENT A NUCLEAR WAR?

Mindscape introduces a new game for the Macintosh—"Balance of Power." Players assume the role of either the President of the United States or the General Secretary of the Soviet Union for a fictional, eight-year period in this one or two player game. The goal is to enhance their country's prestige and avoid nuclear war. They can support friendly governments, move against unfriendly governments and try to foil the same efforts of their opposing superpower.

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Mindscape Inc., 3444 Dundee Road, Northbrook, IL 60062, (312) 480-7667. Circle 74 on Reader Service Card

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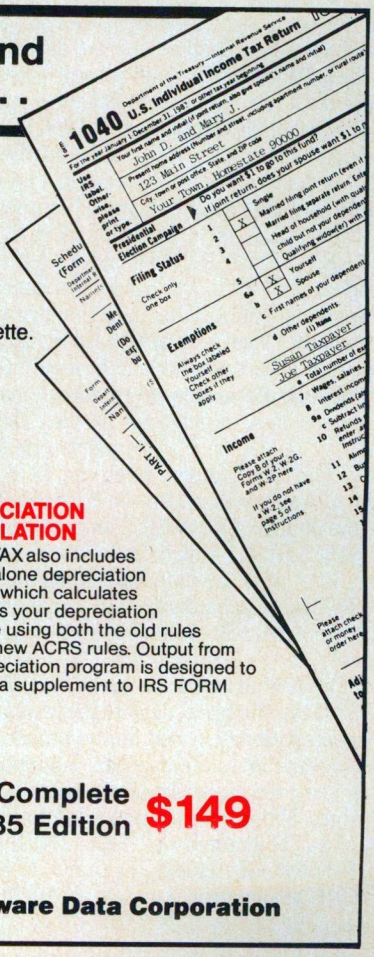

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FOR DEPRECIATION CALCULATION
SUPERTAX also includes a stand alone depreciation program which calculates and prints your depreciation schedule using both the old rules and the new ACRS rules. Output from the depreciation program is designed to serve as a supplement to IRS FORM 4562.

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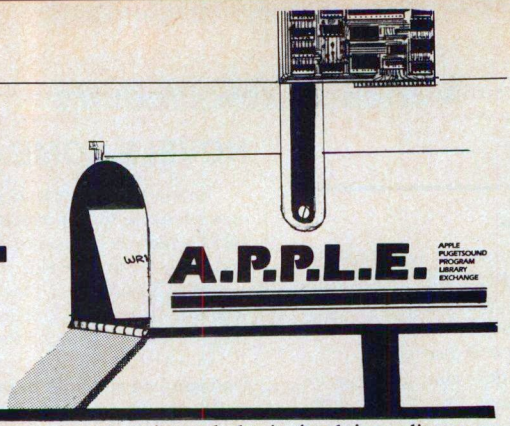

Readers' forum

Where Are Those Entry Points?

Two respectful (but disgruntled) replies to Bruce Tognazzini's letter in the July 1985 issue. First, regarding the call for programmers to use 'published" entry points: if there is *any* such list for machine-language use of the 80-column firmware, including the necessary "PICK" function (especially for the old //e ROMs), I would be most grateful to be told where I can obtain it. I have been trying to beg, borrow, or buy such a reference since late 1983 (or is it unavailable to end users?). MAGIC MENU in *The Applesoft Tutorial* for the //e is the only programming example (and why were there no examples in the 80-column card docs?)

Second, please note that due to the extreme sloth of the character I/O on the old //e ROMs (and some bugs) that going through the "published"(?) entry points is not possible for some software/hardware configurations. One combination we have discovered is the Z-PRO communications software running with the Microsoft Softcard and a Novation Apple Cat modem at 1200 baud (it dropped characters on a //e with the old ROMs despite interrupt support). I had the same problem with a Hayes Micromodem (at 300 baud!) on a //e using ASCII EXPRESS -THE PROFESSIONAL; the modem had to have hardware interrupt generation enabled so that the firmware would not "lose" characters (to be fair, the new //e ROMs solve both of these problems.

Several programs were forced to circumvent these deficiencies by the "illegal" calls, or by inclusion of an independent set of screen I/O routines. Even the DOS version of Applewriter II for the //e avoided use of the ROMs. CONVERT on the ProDOS /USERS.DISK, which uses direct screen handling, generates MouseText on the new //e ROMs, so apparently even Apple proper has problems with following their "conventions".

This is not to criticize Apple for the new //e ROMs, which are, despite the headaches of incompatibility, a vast improvement. It is also not meant to criticize Mr. Tognazzini's call for good programming practice over kludges. Programming methods introduced by Mr. Tognazzini in THE INFINITE NUMBER OF MONKEYS and MAGIC MENU are standard tutorials on Apple programming.

It *is* meant to point out that there have been persistent holes in Apple's quality control (the old //e ROMs), and in their documentation that have not been remedied since the introduction of the //e. For Apple to point the accusing finger in these circumstances seems unfair to the conscientious programmer who commits an act of "hacking the code" in his frustration over trying to make things work. In truth, the 80-column input/display routines of MAGIC MENU are a prime example; systems programming in BASIC to overcome deficiencies in the original //e ROMs speaks for itself.

Dennis Doms

Comments on Mac Coverage from the C.R.A.T.E.

I have been a member of A.P.P.L.E. since 1978. I joined to find info on the Apple II. I think the quality of info from A.P.P.L.E. has been great. However, there is always a however, in the last year or two, the magazine has moved more and more to the Mac. I suppose the Mac is a fine computer. I don't really know. The point is, I'm not interested in the Mac. If I was I would seek out a magazine on it. I would like to request that *Call -A.P.P.L.E.* go back to supporting the Apple II. It's a great machine, and I know there is much to be learned about it yet. I suppose if I'm the only one that feels this way it will not happen, but I guess I would like to know if there are any others out there that feel the way I do.

Bill Shryock

This is intended to be my comment in response to Bill Shryock's previous message.

I am a proud owner of an Apple II. The articles written in our magazine about the Mac are of no/little use to me, just like all of this magazine's articles were before 1982. The truth be known, I sure am glad that as these few years have gone by more and more of what is written about my Apple can be understood by, yes even, me! From what I can tell on the 'Crate, a good number (???) of our membership has both machines. Envy, drool, covet—covet. I think we would do ourselves a diservice by ignoring the Mac. Maybe we could reach back to the days of 80 pages or so. For what it is worth . . .

Dave Cook

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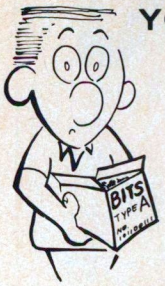

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AppleWorks Printer Flexibility

In the October '85 A.P.P.L.E. Doctor, Bruce Field states that: "AppleWorks is designed to work with the Apple Super Serial Card and the ImageWriter Printer. Using anything else can produce problems . . ." I believe this statement does not accurately present the full story.

The first release of AppleWorks was designed to use any printer interface card that obeyed the "Control-I 80N" command. This included the Apple Serial Card, the Apple Parallel Card, the APL Epson Card, and most other "unintelligent" interface cards made for the Apple since 1978.

Problems usually occur when an interface card contains extra intelligence, such as buffering, pagination, and graphic dumps. These cards frequently have different initialization commands and thus retain their default settings. To get an intelligent card to behave, you need to send a custom command sequence like "Control-I ON" for the Grappler , or "Control-I T" for the Printerface Card.

Admittedly, the first release of AppleWorks had no way of redefining these commands, and so Apple quickly supplied an *Interface Configuration Utility.* Then Apple released *AppleWorks1.2* with a place to install your own printer initialization commands. Dealers were sent the new version with instructions to update owners of the old version.

As to printers; The "Add A Printer" menu in AppleWorks has always contained at least eleven printer definitions ranging from the Apple DMP to the Qume Sprint. It also has a custom printer definition available in which you can install any codes that you might need. Since its release, I've interfaced AppleWorks to everything from the Juki portable typewriter for one client to a CompuGraphics Typesetting machine for another.

I'm convinced that AppleWorks can print on anything that understands ASCII.

Frank Jaubert

RND (Random) Comments

Hare, Russ, Faulkner, and Sparks, (*Call -A.P.P.L.E.,* January 1983, pp. 29-34) have demonstrated that the Applesoft RND function is badly flawed, and have put forward an excellent replacement. Their replacement, USRND, is a machine language routine which, for each seed, generates an acceptable (pseudo) random sequence. Yet there is a problem. Normally, for a simulation experiment some number, s, of seeds are chosen, and the experiment runs s times—one run for each seed, and then some type of average is formed. Now, USRND is seeded by inserting code such as

```
123 S = RND(negative value)
124 CALL 768
```

into the simulation program, and then random numbers X are generated by a line of code

```
246 X = USR(1)
```

Suppose now that we wish to run some simulation experiment, say, ten times. We might choose -1, -2, . . . , -10 as seeds, and proceed with our ten runs. And that is the problem, because -2, -3 generate the same (pseudo) random sequence, as do -4, -5, -6, -7, and as do -8, -10. Thus, multiple runs of a simulation may produce poorly distributed results, even though each individual experiment is a valid run.

There are several methods for resolving this seed predicament. One method is to seed USRND directly. This can be accomplished with a line of code such as

```
345 POKE 953,U1:POKE 954,U2:POKE
    955,U3:POKE 956,U4
```

with the proviso that U1, U2, U3, U4 are not greater than 154, 219, 255, 3 respectively. Alternatively, USRND can be seeded thru Applesoft by code

```
345 POKE 202,A1:POKE 203,A2:POKE
    204,A3:POKE 205,A4
346 CALL 768
```

The advantage of this Applesoft seeding over the normal Applesoft seeding above is that different values of A3 will produce different USRND seeds. The reason for this is that A3 is masked with "FF" to produce U3. In either case, enough distinct seeds can knowingly be produced so that an accurate distribution of simulation results can be obtained.

As a last comment, I wish to describe a difficulty I had in learning to use USRND. When I "BRUN USRND," as indicated in the 1983 article, the machine responded by appending "9E" to "BRUN USRND," and then hanging. To circumvent this problem, I "BLOAD USRND," and then "CALL 756" instead of "CALL 768." The extra twelve bytes, in the initial call only, appear necessary to insure that the JMP instruction needed by USR is loaded.

William Jackson
34509 Spring Valley Drive
Westland, MI 48185

Ooops! A.P.P.L.E. Doctor

A.P.P.L.E. Doctor is one of my favorite columns in the magazine. When I read the Q & A on "Garbage Collection Bug" on page 40 of July-85, it looked familiar. I looked in some old *Call -A.P.P.L.E.'s,* and ran across the exact Q and exact Ans. in the April-85 issue, page 38.

I should have known, summer is the rerun season. Thanks for providing us with interesting and usually new information each month.

Tony Pizza

The mistake was ours, not the author's. Congratulations on your keen eye.—The Editors

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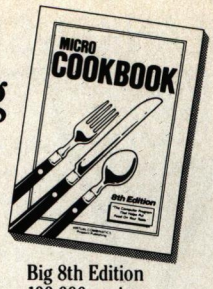

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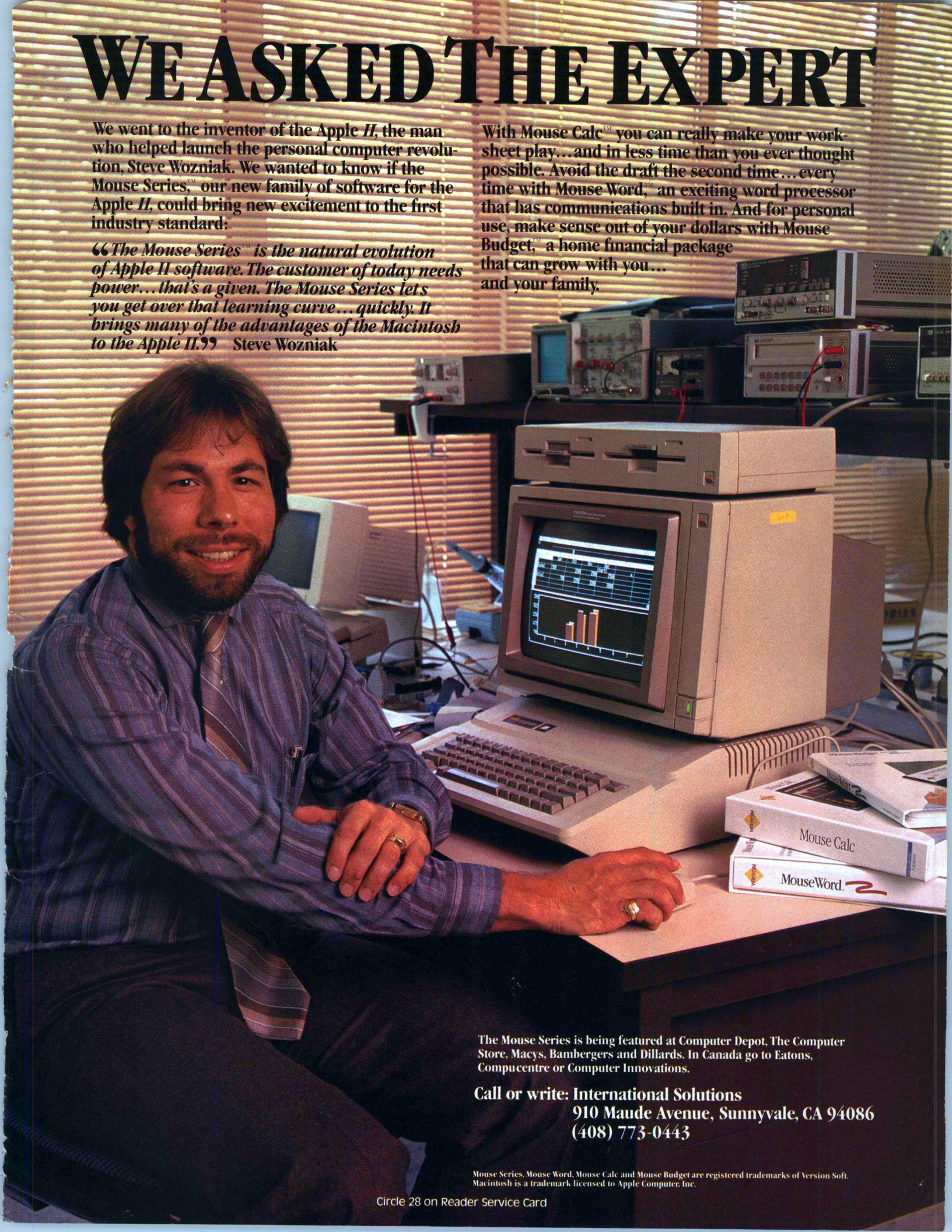

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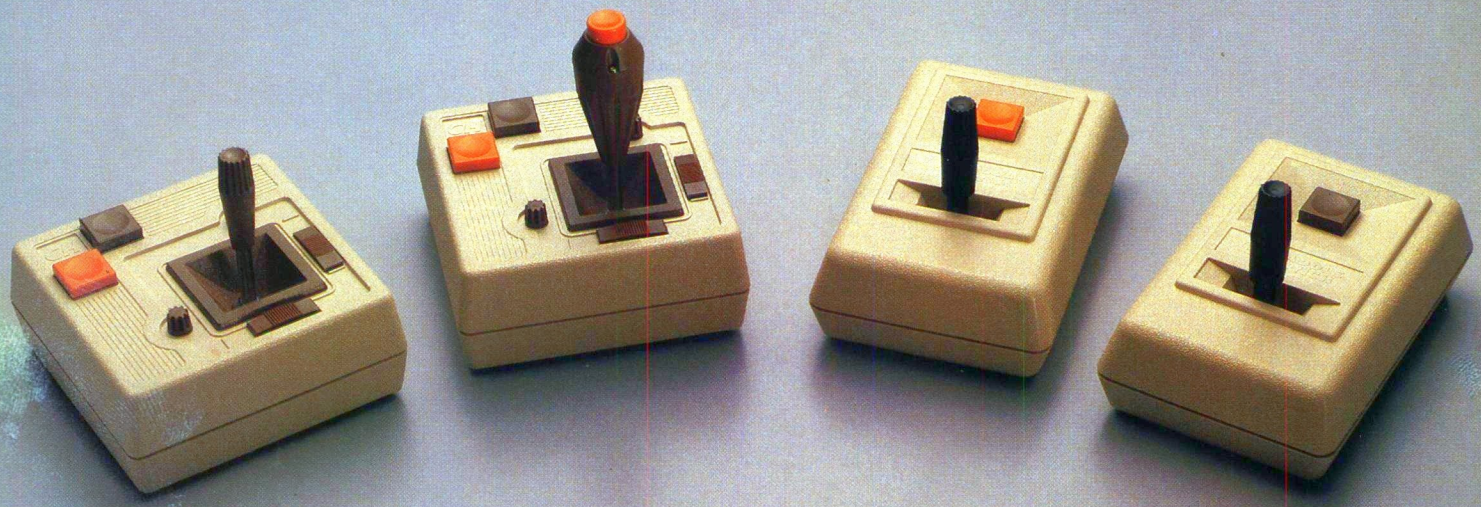

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